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IN THIS ISSUE

ORIGINAL ARTICLES:

- ACCIDENTAL GROUP EXPOSURE TO ACETONITRILE—A CLINICAL STUDY.....*Marvin L. Amdur, M.D.*
- AN INVESTIGATION OF THE MAMMALIAN TOXICITY OF ACETONITRILE.....*U. C. Pozzani, M.S.; C. P. Carpenter, Ph.D.; P. E. Palm, Ph.D.; C. S. Weil, M.A.; and J. H. Nair III, M.S.*
- RADIATION PROTECTION—STANDARDS AND LAWS.....*D. C. Fleckenstein*

TOPICAL REVIEW:

- FLUORIDES: A CRITICAL REVIEW—II. ANALYSIS OF FLUORIDES.....*Jacob Cholak, Ch.E.*

INDEX TO VOLUME I, JANUARY THROUGH DECEMBER, 1959

Complete Table of Contents on Page 3*a*

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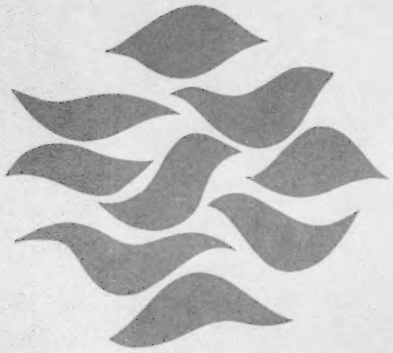

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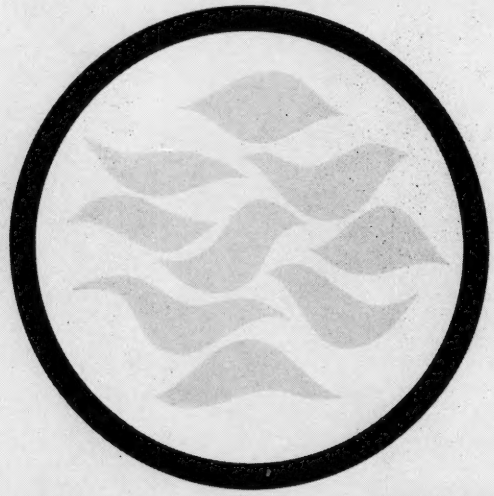

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ISSUE OF DECEMBER 1959

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TABLE OF CONTENTS

TEXT SECTION

Original Articles

ACCIDENTAL GROUP EXPOSURE TO ACETONITRILE—A CLINICAL STUDY.....627
Marvin L. Amdur, M.D.

AN INVESTIGATION OF THE MAMMALIAN TOXICITY OF ACETONITRILE.....634
U. C. Pozzani, M.S.; C. P. Carpenter, Ph.D.; P. E. Palm, Ph.D.; C. E. Weil, M.A., and J. H. Nair III, M.S.

RADIATION PROTECTION—STANDARDS AND LAWS.....643
D. C. Fleckenstein

Topical Review

FLUORIDES: A CRITICAL REVIEW—II. ANALYSIS OF FLUORIDES.....648
Jacob Cholak, Ch.E.

The President's Message.....655

Editorials

EMPLOYMENT OF THE HANDICAPPED.....656

YEAR END.....657

Book Reviews.....658

Letters.....659

Abstracts

MENTAL HEALTH.....660
Graham C. Taylor, M.D.

RADIATION HEALTH.....661
W. D. Norwood, M.D.

INTERNAL MEDICINE.....662
John J. Thorpe, M.D.

Abstracts—Continued

MEDICAL CARE ADMINISTRATION.....662
Asa Barnes, M.D.

INDUSTRIAL HYGIENE.....663
Edward C. Riley, M.D.

EXPERIMENTAL TOXICOLOGY.....664
Robert E. Eckardt, Ph.D., M.D.

REPARATIVE SURGERY.....665
Robert J. Trettin, M.D.

DERMATOLOGY.....666
Raymond R. Suskind, M.D.

CLINICAL TOXICOLOGY.....667
Lee H. Miller, M.D., I.M.D.

NOISE AND HEARING.....668
H. O. Parrack, Ph.D.

Index to Volume I, January through December, 1959.....669

GENERAL SECTION

Industrial Medical Association

OFFICERS AND DIRECTORS.....*6a*

DISTRICT COUNSELORS.....*16a*

COMMITTEES.....*20a*

COMPONENT SOCIETIES.....*24a*

ASSOCIATION ACTIVITIES.....*25a*

About the Authors.....*27a*

People and Events.....*30a*

Directory of Advertisers.....*34a*

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The Industrial Medical Association was organized in 1915 as the American Association of Industrial Physicians and Surgeons. Its first annual meeting was held the following year. In 1951 the present name was adopted.

The purposes of the organization as stated in the certificate of incorporation (not-for-profit) are:

"The object of this Association will be to foster the study and discussion of the problems peculiar to industrial medicine and surgery; to develop methods adapted to the conservation of health among workers in the industries; to promote a more general understanding of the purposes of the medical care for employees; and to unite into one organization members of the medical profession specializing in industrial medicine and surgery for their mutual advancement in the practice of their profession."

Presently, the membership totals nearly 4000 physicians in the United States, Canada, Latin America, and other parts of the world. Physicians "who have an interest in Industrial Medicine" may apply for membership; specialization in this field is not essential. Regionally, the Industrial Medical Association has 14 Component Societies in the United States. Most Association members carry their membership through one of the component groups.

The Journal of Occupational Medicine, owned and published by the Industrial Medical Association, is sent monthly to each member as one of the advantages of membership.

The annual business meeting and convention is held in the spring. Since 1945, the convention has been held concurrently with the meetings of four other organizations having related interests—American Industrial Hygiene Association, American Conference of Governmental Industrial Hygienists, American Association of Industrial Nurses, Inc., American Association of Industrial Dentists. This combined meeting is known as the Industrial Health Conference.

The Occupational Health Institute, Inc., is a nonprofit educational organization created by the Industrial Medical Association to promote the cause of health in industry. Since 1951, the Occupational Health Institute has conducted the program of evaluation, approval and certification of Medical Services in Industry, on the basis of standards established by the Standards Committee of the Industrial Medical Association. This program was conducted by the American College of Surgeons for many years until its transfer to the Association.

The Association's headquarters office serves as a focal point for the Association's activities, and through its coordination of information regarding industrial health problems encountered throughout the country, it offers invaluable assistance to members on a host of specific subjects.

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Through its District Counselors, the Industrial Medical Association is represented regionally throughout the United States and Canada. Each district is served by a Counselor appointed by the President of the Association. The District Counselor reflects the attitude of the membership of his district in his relations with the national organization, and in turn, reports and interprets policies of the Association to the membership and the general public in his district.

An important function of the District Counselor is to serve in a liaison capacity with the Component Society of the Industrial Medical Association in his area. The District Counselor also is concerned with regional trends in industrial medical practice and in legislation bearing upon medical service in industry. He is ready to assist any physician with questions or problems.

In promoting the cause of industrial medicine, many District Counselors work with the industrial health committees of their state medical societies, they participate in teaching programs at hospitals or medical schools, and serve as speakers at meetings of groups that express interest in occupational health. Throughout these activities, the District Counselor attempts to stimulate membership in the Industrial Medical Association by acquainting others with the organization's purposes and facilities.

By keeping in close contact with members in his area, the District Counselor gains a familiarity with their work which enables him to make recommendations to the Association's officers and committees regarding those qualified for various positions or honors. He recommends members for committee work, and for fellowship, and recommends fellows for consideration for elective offices in the Association. He also recommends possible recipients for the awards presented at the annual meeting of the Association—the Knudsen Award, the Health Achievement in Industry Award, the Meritorious Service Award and the Merit in Authorship Award.

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Association Activities

Abstract of Minutes of Board of Directors Meeting at Headquarters Office, October 12, 1959

President Lauer welcomed the new directors and explained the organizational functions, duties and responsibilities of the officers, directors and headquarters staff.

Treasurer Norris reported that the financial situation is improved, due to several factors—the effectiveness of the membership campaign, the financial assistance of the component societies, the fact that the Journal of Occupational Medicine is now paying its own way, and the profit due I.M.A. from the 1959 Industrial Health Conference. Consequently, the year may end without much, if any, depletion of our financial reserves.

Secretary Arling presented for approval the minutes of Executive Committee meetings dated April 25, May 1, and September 19, 1959, and the Board of Directors minutes of April 28, 1959.

The Board—

Approved appropriations for the purchase of a modern addressograph machine and a Pitney-Bowes mailing machine.

Approved a plan to provide group life insurance for headquarters staff employees through membership in the American Society of Association Executives.

Received progress report on the Journal of Occupational Medicine. The number of non-member subscribers is increasing gradually. There has been healthy growth in the number of advertisers and amount of advertising revenue. The Journal is now on a paying basis and offsetting the losses of the early months of publication. Prospects for 1960 are bright from both the business and editorial standpoints.

Approved the appointment of Edward V. Henson, M.D., as Assistant Editor of the Journal of Occupational Medicine, in charge of the Abstract Section, effective January 1, 1960.

Approved the employment of an Editorial Assistant by Dr. Kammer, effective June 1, 1959.

Approved the independent accounting firm's report of audit of the 1959 Industrial Health Conference. Expenses were allocated by association and considered in the division of the net income of the Conference on the basis of registrations. The number of registrants for each association and its share of the net income are shown in the table below. The Managing Director was authorized to send a check to each organization with a copy of the audit report in accordance with established custom.

Industrial Medical Association (780)	$5,742.12
American Association of Industrial Nurses (528)	3,873.96
American Industrial Hygiene Association (642)	3,740.21
American Conference of Governmental Industrial Hygienists (128)	667.33
American Association of Industrial Dentists (12)	35.23

Received progress report relative to the 1960 Industrial Health Conference to be held in Rochester, New York, April 24-29. Representatives of the various participating organizations met in Rochester on October 9, reviewed the hotel facilities and the War Memorial Auditorium exhibit and meeting room arrangements.

Approved, in principle, a plan for rescheduling and consolidating some of the IMA organizational meetings prior to the scientific program to give officers and directors more free time during the Conference. New counselor and committee appointments are to be made by the President-Elect early enough to get new activities under way promptly.

Approved a plan to require final committee reports to be submitted to the headquarters office by March 1, to permit duplication and circulation to the directors in ample time prior to the annual meeting.

Acknowledged receipt of the official notice from President Elmer Wheeler, of the American Industrial Hygiene Association dated September 14, 1959, of their decision to discontinue participating in the Industrial Health Conference after 1960. AIHA plans to hold its annual meeting independently in 1961.

Agreed to re-examine the suitability of locations for future Industrial Health Conferences, after 1960, in view of the change in composition of the Conference. The absence of AIHA will reduce meeting room requirements, especially for multiple simultaneous sessions. This change increases materially the number of hotels that could handle the Conference successfully, and largely eliminates the need to use convention halls.

Approved a plan to appoint District Counselors for Cuba and Puerto Rico.

Approved May 31 as the date on which delinquent members are to be dropped from the membership rolls. Members are considered delinquent, and mailing of Journal to be discontinued, when dues are not paid by April 30th, as stated in the by-laws.

Approved a plan of automatic transfer of membership from one component society to another when members move to another jurisdiction, provided that there shall be no transfer of dues after April 30. The same principle is to apply when a member transfers from a 'direct' status to a component society area, and vice versa.

Approved the publication of an up-to-date roster of the membership. The staff is to investigate various possible methods and undertake the publication at the earliest feasible opportunity.

Tabled report of Workmen's Compensation Committee for further study.

Approved a budget allowance of $300 for ladies' entertainment during the Rochester Conference. Denied a request for an increase to $500.

A well-balanced moderate low-fat breakfast for teen-age girls, 16-19 years

When a moderate reduction of dietary fat is indicated for girls in their late teens, the basic cereal and milk breakfast merits consideration. *This breakfast is moderately low in fat because its fat content of 10.9 gm. provides 20 per cent of the total calories.* As shown in the table below, it contributes *well-balanced nourishment.* It provides "Girls, 16 to 19 Years" with approximately one-fourth of the recommended dietary allowances[1] of complete protein, important B vitamins, essential minerals; and provides quick and lasting energy.

recommended dietary allowances and the nutritional contribution of a moderate low-fat breakfast*

Menu: Orange Juice—4 oz.;
Cereal, dry weight—1 oz.;
Whole Milk—4 oz.; Sugar—1 teaspoon;
Toast (white, enriched)—2 slices;
Butter—5 gm. (about 1 teaspoon);
Nonfat Milk—8 oz.

Nutrients	Calories	Protein	Calcium	Iron	Vitamin A	Thiamine	Riboflavin	Niacin equiv.	Ascorbic Acid
Totals supplied by Basic Breakfast**	503	20.9 gm.	0.532 gm.	2.7 mg.	588 I.U.	0.46 mg.	0.80 mg.	7.36 mg.	65.5 mg.
Recommended Dietary[1] Allowances—Girls, 16 to 19 Years (54 kg.—120 lb.)	2400	75 gm.	1.3 gm.	15 mg.	5000 I.U.	1.2 mg.	1.9 mg.	16 mg.	80 mg.
Percentage Contributed by Basic Breakfast	20.9%	27.9%	40.9%	18.0%	11.8%	38.3%	42.1%	46.0%	81.9%

* *Revised 1958. Food and Nutrition Board, National Research Council, Washington, D.C.*

** *Cereal Institute, Inc.: Breakfast Source Book. Chicago: Cereal Institute, Inc., 1959.*
Watt, B. K., and Merrill, A. L.: Composition of Foods—Raw, Processed, Prepared. U.S.D.A. Agriculture Handbook No. 8, 1950.

[1] *The allowance levels are intended to cover individual variations among most normal persons as they live in the United States under usual environmental stresses. Calorie allowances apply to individuals usually engaged in moderate physical activity. For office workers or others in sedentary occupations they are excessive. Adjustments must be made for variations in body size, age, physical activity, and environmental temperature.*

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Journal of Occupational Medicine

Accidental Group Exposure to Acetonitrile

—*A CLINICAL STUDY*—

Marvin L. Amdur, M.D., Buffalo, New York

SOME TIME ago, a report of an industrial exposure to methyl cyanide (acetonitrile) resulting in a fatality was reported.[1] The clinical material relative to that exposure has not been published for a variety of reasons, some valid, which enjoined the author from reporting. With the passage of a few years all obstacles have been cleared.

The exposed personnel were engaged in applying corrosion-resistant materials to the interior of chemical tanks. The original work contract had been completed, but, because of the difficulties encountered in applying the coating materials by spraying, the work was not satisfactory and the entire operation had to be repeated. This required preliminary preparation of the tanks, and this was performed by the concerned employer. The actual application of the coating and its preliminary mixing were accomplished under the supervision and direction of the vendor. The tank under consideration was one of 5,000 gallon capacity, approximately 20 feet high, and 9 feet in its greatest diameter. In construction, it consisted essentially of two half-tanks, one superimposed upon the other, with a steel bulkhead between them. Entrance to the tank was gained through an 18-inch manhole at both the upper and the lower level. There were 14 ports varying in diameter from 3 to 9 inches entering each tank-half, circumferentially. It was intended that an adequate air supply would enter each section through the multiple ports and through a 5-inch fabric duct which entered each compartment through the manhole sufficiently to direct its stream upward and into the tank interior. Spent air was exhausted through the same multiple ports and through an exhaust duct placed in the tank just within the manhole opening. Thus, both manhole and ports each served a dual function depending upon the state of air pressure within the tank compartment. The general configuration of the tank and the exhaust is shown in Figure 1.

During the several weeks preceding the exposure date of Sept. 21, 1954, the tank surfaces were prepared by ventilating, steaming, and chipping away of the previous unsatisfactory lining. The work surfaces were sand-blasted immediately prior to the application of the new coating so that oxidation of the exposed surfaces would not interfere with the adhesion of the coating materials.

The coating materials consisted of a primer, the chief ingredient of which is a phenolic resin; a catalyst containing diethylene triamine, a mercaptan substance, thiokol, and 30%-40% methyl cyanide (acetonitrile); a thinner containing 90%-95% methyl cyanide; and a small amount of mica.

As the work progressed, on Sept. 21 it became apparent that the coating materials were not satisfactorily adhering to the walls and that, because of the viscosity of the materials, hand-brushing became almost impossible. The

Dr. Amdur is Assistant in Preventive Medicine and Public Health (Industrial Hygiene), University of Buffalo School of Medicine.

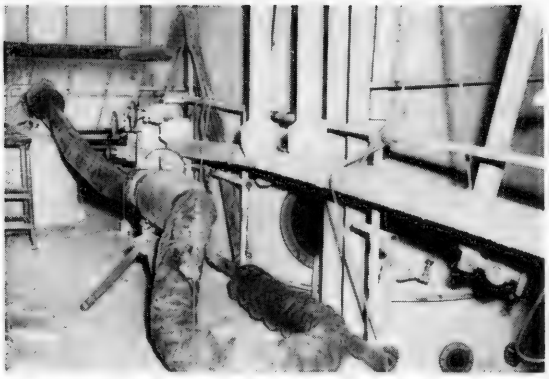

Fig. 1—Tank, showing manhole and portholes as well as flexible exhaust duct.

following innovations were introduced into the operation for the next day: (1) The primer was heated in an adjacent hot air stream oven to a temperature of 25°C and then promptly mixed with other ingredients, thinned, and applied to the wall of the tank in a relatively fluid state. (2) Positive air flow was eliminated entirely, and exhaust air from the manhole continued for only 45 minutes late in the afternoon of Sept. 22, because it was felt that the excessive air flow was causing the lining to "set up" too rapidly.

In all, 16 men were involved in this operation. Not all worked within the tank. Some did not paint but were assigned mixing and miscellaneous labor jobs about the primary operation. All men, however, had contact with acetonitrile on the day of general exposure.

Report of Cases

CASE 1—S.B., 23-year-old man was engaged in hand-brushing the upper section from 8 a.m. to 3 p.m., and from 3 p.m., until 8:30 p.m., on Sept. 22, working with others painting in the lower section. He rode home from work with other members of the crew and apparently made no complaint of illness at any time during the evening. The subsequent history as obtained from his wife was that he awoke shortly after midnight complaining of not feeling well and particularly of chest pain. Nausea, enemis, and a massive episode of blood-spitting followed by a convulsive seizure occurred in rapid succession. His wife called a nearby hospital and he was admitted to the emergency room in a comatose state at about 9:15 a.m. The only significant notations made by the house staff prior to death, which occurred within one hour of admission, indicated that his color was ashen gray. Respirations were shallow, irregular, and infrequent. Convulsive seizures and marked nuchal rigidity preceded death due to central failure.

A postmortem examination disclosed nothing remarkable beyond notable evidence of cerebral, thyroid, liver, splenic, and renal congestion on gross examination, confirmed as the sole significant finding on histopathology examination. The pathologist reported a "peach pit" odor to all tissues, but this was not particularly evident to the author, whose presence at the necropsy was his first contact with the deceased subsequent to his preplacement examination of Sept. 8, 1954, at which time his general health status was excellent.

Table I (Case 1)—Concentration of Cyanide Ion

	μg %
Blood	796
Urine	215
Kidney	204
Spleen	318
Lungs	128
Gastric content	Trace
Liver	0

A preliminary investigation of the work materials indicated that an organic cyanide might be the responsible agent. This was verified within a few hours. Blood and other body fluids as well as certain of the organs were submitted for toxicological study.* They were reported to contain cyanide ion in concentration indicated in Table I.

CASE 2—C.B., a 35-year-old field supervisor, arrived at the work site late in the afternoon of Sept. 22 and thereafter painted in the lower section for about three hours. He stated subsequently that he felt perfectly well all evening, slept without interruption, and awoke in the morning still feeling well and without complaint. He walked several miles to work and then had breakfast. He stated that he then began to feel "all beat up," lightheaded, and weak. Severe nausea and bile-stained emesis followed. Examination at 8:20 a.m., Sept. 23, revealed only a singularly rapid pulse. Skin color was good, and examination of the heart, lungs, abdomen, and central nervous system revealed no abnormalities. Blood pressure was 138/82 mm Hg. A single urinalysis indicated 2+ albuminuria, but no abnormalities were observed in the microscopic examination of the sediment. Inquiry as to his work activity did not elicit any immediately suspicion-arousing information. He was advised not to work but to remain at home and to keep in contact for the next 24 hours. Shortly thereafter, word was received of the hospitalization and death of S.B whereupon C.B. was promptly alerted and hospitalized by 10:30 a.m. of the same day. By this time, his general status had deteriorated. Pallor was marked. The skin was cool. The pulse rate was 55 per minute, and a blood pressure reading

*Blood cyanide was determined by the method of Feldstein and Klendshoj (Feldstein, M., and Klendshoj, N. C.: The Determination of Cyanide in Biological Fluids by Microdiffusion Analysis, *J. Lab. & Clin. Med.* 44:1, 1954). The procedure used in serum thiocyanate determinations is described in the following publications: Barker, M. H.: The Blood Cyanates in the Treatment of Hypertension, *J.A.M.A.* 106:10, 1936; Standard Procedures for Use with Lumetron Photoelectric Colorimeter, New York, Photovolt Corporation.

Table II (Case 2)—Laboratory Data

	Blood Cyanide Recoveries, μg %	Serum Thiocyanate Determinations, mg %
9/23/54 10:30 a.m.	306	....
9/23/54 7:30 p.m.	193	....
9/23/54	....	16
9/24/54	212	15
9/25/54	218	....
9/26/54	....	12
9/27/54	102	....
9/28/54	....	13
9/29/54	....	10
9/30/54	34	9
10/1/54	....	8
10/3/54	....	7
10/6/54	....	3.5
10/9/54	....	3
10/19/54	....	3
10/28/54	0	....

miscellaneous determinations		
9/25/54	Co_2-combining power	46 vol %
	Urea nitrogen	21 mg %
9/27/54	Cephalin flocculation	Negative at 48 hr
9/30/54	Urea nitrogen	30 mg %
10/1/54	Nonprotein nitrogen	38.5 mg %
	Icteric index	7.3 units
10/2/54	PSP (renal function)	
	1st sample	51%
	2nd sample	27.5%

was not obtainable. Respirations were shallow and reduced in frequency. Although he was conscious, lassitude was extreme. It was difficult to hold his attention for more than a few seconds at a time. Nausea and emesis associated with crampy abdominal pain were present. Therapy was entirely supportive and consisted of oxygen by nasal catheter, fluids and whole blood intravenously, ascorbic acid, and sodium thiosulfate. By early afternoon, improvement was marked. The pulse rate had accelerated to 110 per minute. The oral temperature, which had been distinctly subnormal on admission, rose to 100°F. All deep tendon reflexes, which on admission were barely obtainable, became quite active. Twelve hours after admission most subjective complaints, including the abdominal pain, had ceased. The patient returned to work by Oct. 4, with occasional complaint of headache, lassitude, and intermittent palpitation. Subsequent investigations of the heart and lungs as well as thyroid function did not reveal any abnormalities. These complaints gradually disappeared, but an additional complaint of painless urinary frequency has persisted to the present. The albuminuria discovered on Sept. 22 has persisted to the present time, varying only slightly in extent. The formed elements of the sediment have included only a rare white blood cell and an occasional hyaline cast. Full and complete urologic investigations over the ensuing years, including studies of excretory function, blood chemistry, urine cultures, and animal inoculation, have not produced a satisfactory explanation for the continuing urinary frequency and albuminuria.

It was unfortunate that as a member of supervision, C.B. did not have a preplacement examination. It may well have been that the abnormal urinary findings actually preceded the date of exposure. Since 1955, C.B. has experienced acute epididymo-orchitis on three separate occasions. In each instance the complaint has subsided after simple, conservative care. His health status today is otherwise excellent. The data pertinent to his acute illness are presented in Table II.

CASE 3—W.H., a 28-year-old man, was located through a relative as a result of an immediate effort made to locate and account for all members of the work crew at the time C.B. was hospitalized. He was brought into the hospital via ambulance at 12:30 p.m. in a semiconscious state. On admission, his color was slate gray, with a particularly prominent circumoral pallor. The pulse rate was 45 per minute, and the pulse was of very poor quality. Blood pressure was 100/50 mm Hg. The oral temperature was distinctly subnormal. Respirations were shallow and intermittent. The patient would respond to repeated and insistent stimulation, but motor power was so impaired that he could not speak or, in fact, lift his eyelids to look at the examiner. It was impossible to evaluate cranial nerve function. Deep tendon reflexes were not elicited. Superficial abdominal and cremasteric reflexes were present.

Therapy was the same as employed for C.B. Within a half-hour there was notable improvement, with a return of color, increase in pulse rate, and elevation of blood pressure to 112/78 mm Hg. Late the same evening, the oral temperature rose to 101°F, and it reached a maximum of 102°F after 48 hours.

When W.H. was sufficiently improved to talk with the examiner, it was learned that he had been working about 12 hours daily since Sept. 20 and that on Sept. 22 he had spent most of the day painting about the ports from the outside of the tank. The last hour of work, however, was spent with S.B. and C.B. painting the tank interior. He stated that he felt quite well on leaving the job and continued to feel well until about 11 p.m., at which time he noted some chilly sensations. During the night, he had several episodes of painless diarrhea. By morning he felt nauseated, weak, and extremely listless. He did not feel able to get up to go to work and recalls nothing of the later hours of the morning until he was discovered by his sister and hospitalized.

In the subsequent hospital course, W.H. developed a transient paresis of the flexor muscles of both hands and wrist, right upper quadrant abdominal pain, and an annoying urinary frequency. These abnormalities disappeared by Oct. 3, at which time he left the hospital. Complaints of intermittent headache and continued listlessness persisted after discharge. The laboratory data pertinent to the acute episode are shown in Table III. Findings on other clinical and laboratory studies

Table III (Case 3)—Laboratory Data

	Blood Cyanide Recoveries, μg %	Serum Thiocyanate Determinations, mg %
9/23/54	970	15
9/24/54	1,088	23
9/25/54	880	....
9/26/54	....	20
9/27/54	296	....
9/28/54	....	10
9/29/54	....	11
9/30/54	140	....
10/1/54	....	10
10/2/54	....	9
10/12/54	3.5	....
10/28/54	0.0	....

Miscellaneous determinations

9/23/54	CO_2-combining power	52 vol %
	Urea nitrogen	25.9 mg %
9/25/54	Cephalin flocculation	Negative at 48 hr
	Bromsulphalein test	Normal recovery
9/30/54	Urea nitrogen	20.0 mg %
10/1/54	Urea nitrogen	20.5 mg %

Multiple urinalyses completed during hospital stay were entirely negative

Several routine complete blood counts indicated only moderate transient leukocytosis

performed during hospitalization, including chest roentgenogram and electrocardiogram, were all within the normal range.

W.H. returned to work about Oct. 10, essentially free of all complaint. On Oct. 16, he passed a single urinary calculus which he recovered and brought in for examination. Several days later a second calculus, not recovered, was passed. A full urologic investigation demonstrated no pathologic conditions anywhere in the renal excretory tract. Laboratory investigation indicated an equivocal elevation of the serum calcium to 13.7 mg %, as compared with a normal control of 11 mg %. Serum phosphorus and alkaline phosphatase levels were well within normal limits. The small size of the calculus, weight 11.5 mg, rendered extensive analysis difficult. Figure 2 illustrates the calculus and the oxalate anion component. The additional information concerning the calculus included:

1. X-ray diffraction studies yielded no characteristic pattern.
2. Emission spectroscopy indentified only the presence of calcium, magnesium, and copper cations.
3. Anions demonstrated included phosphates, sulfates, and oxalates. No chloride, cyanate, or thiocyanate anions were demonstrated. Tyrosine, cysteine, or uric acid crystals were not demonstrated.

W.H. was last evaluated in August, 1955, at which time subjective complaint or objective evidence of any disability related to his exposure had ceased.

CASE 4—J.J., a 28-year-old man, arrived at the job site at 5:10 in the afternoon of Sept. 22 and immediately entered the lower tank section. He hand-painted side walls and floor section until 7:40 p.m., at which time he left for home. His only complaint when examined the next morning was headache when he got out of bed. There was no complaint of general weakness, nor was there a complaint directed to the gastrointestinal or urinary tract. A complete general examination revealed nothing remarkable. He was kept in the hospital for observation overnight. The next morning he continued to complain of headache associated with a pounding sensation in his neck. A general examination again revealed no significant abnormality. Blood pressure remained at 136/86 mm Hg. He improved on the administration of amphetamine and simple analgesics and was able to resume his usual work on Oct. 11, 1954. He returned at intervals with complaints of chest pain on effort, undue fatigue, and difficulty in swallowing. Repeated examinations, including chest x-ray studies, fluoroscopy, barium studies of the esophagus, and electrocardiographic study with stress tracings were all within the range of normal. The patient was last examined in mid-January, 1955, at which time it was felt that his recovery was complete, without residual damage. Pertinent toxicological data are presented in Table IV.

CASE 5—P.C., a 20-year-old man, alleged that he had painted for most of Sept. 21 and 22. The actual extent of his work for those days could not be ascertained, but it is unlikely that he had done much painting in the lower section. When initially examined September 23, his only complaint was nausea. The physical examination revealed only normal findings. He too remained in the hospital for continued observation. The next morning he complained of headache and lassitude but he was no longer nauseated. He left the hospital against advice and reappeared in the office on Sept. 25 distinctly lethargic, with prominent complaints of marked weakness, shortness of breath, palpitation, and "pounding in the head and neck" on the slightest effort. A mild elevation of temperature associated with a prominent scattered erythematovesicular eruption of trunk and extremities was noted. He was hospitalized again, and by the next morning he was much brighter and afebrile, though still complaining of headache and breathlessness. He

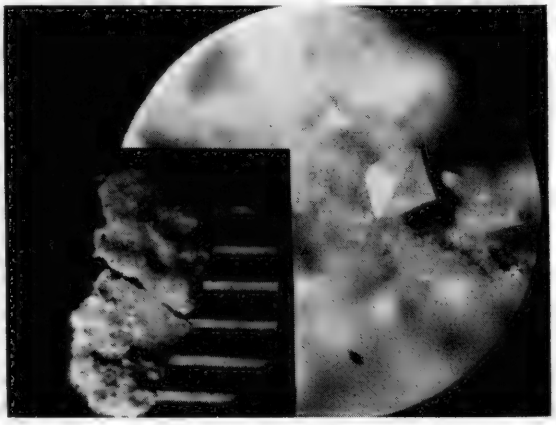

Fig. 2—Case 3: urinary calculus and oxalate component.

Table IV (Case 4)—Toxicological Data

	Blood Cyanide Recoveries, μg %	Serum Thiocyanate Determinations, mg %
9/23/54	72.0	14.5
9/28/54	....	5.0
9/30/54	....	3.5
10/1/54	12.7	....
10/2/54	....	2.5
10/12/54	0.0	....

again left the hospital on Oct. 2. Subsequent general medical examinations revealed nothing remarkable although the complaint of breathlessness persisted. Some mild fullness was noted over the thyroid, but other clinical thyroid signs were absent. Chest x-ray studies as well as serial electrocardiographic studies, some under stress, did not reveal any abnormalities. General examinations on multiple occasions demonstrated a prominent tendency toward hyperventilation. It was felt that this might well be the explanation for continued complaint. He was encouraged to return to work, and several unsuccessful efforts were made. Attendance and productivity were very poor. Employment was terminated, and P.C. left the area. He has not been evaluated since his termination. The pertinent toxicological and clinical laboratory data are described in Table V.

CASE 6—P.N., an 18-year-old white youth, stated that he had been painting for most of Sept. 21, and that on the next day he had alternately sandblasted and mixed paint. He left work at 4:30 p.m. on Sept. 22 and felt quite well until 11:30 p.m., when he began to notice some headache, weakness, and some tightness in his chest and abdomen. He volunteered the comment that it felt just like "zinc chills." These complaints lessened in the early hours of the morning and at the time of examination, about noon Sept. 23, they had practically disappeared. Some breathlessness persisted until Oct. 27, at which time it was felt that he had recovered completely. Pertinent toxicological data are presented in Table VI. At no time were there any abnormal findings on physical examination.

CASE 7—J.P., a 42-year-old man, stated that he had sandblasted on Sept. 21, had worked as a paint mixer on the next day, and had left work feeling well. On arising the next morning he felt nauseated and rather tired. A general physical examination revealed no pertinent findings. All complaint ceased after 24 hours. He returned to work within one week and has continued since without complaint. Pertinent toxicologic data are shown in Table VII.

CASE 8—J.L., a 25-year-old man, had painted for one hour on Sept. 21, and, though present in the work area for the entire day on Sept. 22, he neither painted nor mixed paint. When evaluated on Sept. 23, he had no subjective complaint and the physical examination revealed normal findings. A blood cyanide determination of Sept. 23 was reported as 0 μg % and the serum thiocyanate as 6.0 mg %. He was advised to return to work and to report any change in his status. On Sept. 25, he was hospitalized because of severe pain in his right lower chest and abdomen. Although he never became clinically jaundiced, he did develop obvious evidence of hepatic disability. In addition to a notable elevation of temperature, he exhibited a transient hepatomegaly. Laboratory studies at this time indicated an icteric index of 13.5 units, cephalin flocculation of 2+ after 48 hours, and transient albuminuria. A bromsulphalein excretion test was normal. The hemogram and the blood urea nitrogen were likewise within the normal range. Chest x-ray and electrocardiographic studies added nothing to the solution of the problem. Again blood cyanide and serum thiocyanate determinations were 0 μg % for cyanide and not in excess of 3 mg % on multiple determinations of thiocyanate. It was difficult to relate this disability to the primary question of organic cyanide exposure except for the close time relationship between probable exposure and onset of disability. The possibility was con-

Table V (Case 5)—Toxicological and Clinical Laboratory Data

		Blood Cyanide Recoveries, μg %	Serum Thiocyanate Determinations, mg %
9/23/54		58	18
9/24/54		57	....
9/26/54		....	11
9/28/54		....	8.5
9/29/54		53	8
9/30/54		57	6
10/1/54		....	4
10/9/54		....	3.5
10/13/54		0	....
10/16/54		....	2.5
Miscellaneous determinations			
9/30/54	Basal metabolism	+13%	
10/19/54	Basal metabolism	+25%	
	Serum cholesterol	188 mg % (control 150 %)	

Routine complete blood counts, multiple urinalyses, and determinations of blood sugar, urea nitrogen, and cephalin flocculation were all normal

Table VI (Case 6)—Toxicological Data

	Blood Cyanide Recoveries, μg %	Serum Thiocyanate Determinations, mg %
9/23/54	33	10.0
9/27/54	....	5.0
10/1/54	0	3.5

Table VII (Case 7)—Toxicological Data

	Blood Cyanide Recoveries, μg %	Serum Thiocyanate Determinations, mg %
9/23/54	0	13.5
9/25/54	....	6.0
10/9/54	....	2.0

sidered that some other ingredient in the paint mix might be responsible. He returned to work within a period of two weeks, and, since his recovery appeared complete, the matter was not investigated further.

CASE 9—E.J., a 24-year-old man, had been assigned to mixing paint for three hours on Sept. 22, and he was evaluated with other members of the work crew on Sept. 23. He stated that he had no complaints until arising on the morning of Sept. 23, at which time he was nauseated and felt very listless. Findings on a complete medical examination were normal. Blood cyanide was 0 μg % and the serum thiocyanate was 10.0 mg %. Observation was continued for 48 hours, after which all complaint had ceased. Serum thiocyanate at this time was 3.0 mg %.

Six other workmen were evaluated. These men had performed a variety of duties in the work area on Sept. 22, other than painting or mixing. In each instance there were no subjective complaints and the findings on physical examination were all within the normal range. Blood cyanide determinations were all 0.0 μg %, and serum thiocyanate levels were all under 3.0 mg %.

The work assignment was subsequently completed without incident. The ingredients were not heated and an adequate level of ventilation was provided within the tank. Further air sampling studies during the completion period did not indicate the presence of any free hydrogen cyanide. The maximum level of organic cyanide recovered in the air within the tank did not exceed 17 ppm.

Comment

It is apparent that the physiological response to organic cyanides differs materially from the response to inorganic cyanides. Exposure to inorganic cyanide in the extent exhibited by the accidental situation described would have produced a large number of early fatalities among the significantly exposed members of the work crew. The very fact that disability for most, and the death of S.B., was a delayed response suggests that cyanide per se, with its dramatic cessation of tissue oxidation by inhibition of the cytochrome oxidase system, could not be the direct and immediate cause of disability and death. The usual detoxication process becomes more orderly if cyanide is made available at a slower rate. This process, which is enzyme-dependent, employs rhodanese, present in all tissues except blood and muscle, to convert the cyanide ion to the relatively "harmless" thiocyanate ion. Thiosulfate and colloidal sulfur function well as substrates for this enzyme, but other substances, such as the sulfur-bearing amino acids as cystine, cysteine, and glutathione, may also serve but less effectively.[2] This enzyme may act upon the cyanide of organic nitriles only after such cyanide has been made available by other enzyme action. There is no direct approach.

The detoxification of cyanide need not follow the conventional pattern. There is evidence[3] that some of the cyanide may follow an independent pathway and be converted via the sulfur amino acids, such as cystine, to 2-imino-4-thiozolidine carboxylic acid, a metabolically inert substance, in which form it is excreted in the urine. Further confirmation of this mechanism comes from studies with tagged cystine, L-cystine S^{35}, which indicates that as much as 15% thiozolidine recovery may be expected while 85% may be converted to the usual thiocyanate. Others[4] have demonstrated by animal studies that cystine given intravenously immediately prior to cyanide exposure will protect somewhat by potentiating this detoxification mechanism.

One must assume that some enzymatic action in this exposure situation made possible the slow and protracted release of the cyanide from the absorbed acetonitrile. The delayed and less malignant effect of acetonitrile as compared with other members of the homologous series may be due, at least in part, to the fact that the alkyl groups of the higher members, i.e., ethyl, propyl, and butyl, are more readily oxidized in vivo than are the simpler methyl groups.[2]

That the metabolism of acetonitrile in the mammalian body is not a simple process, was stressed in a report presented at the 1955 Meeting of the American Industrial Hygiene Association.[5] Animal exposure studies yielded fractional mortalities for rats, guinea pigs, rabbits, and dogs after exposure to varying concentrations of acetonitrile. Histological changes were absent. Urinary thiocyanate recovery values even after intravenous administration of acetonitrile and sodium thiocyanate were significantly lower than anticipated, further emphasizing the complexity of detoxification. One observation characteristic of all species was the occurrence of delayed death in many instances.

It is quite probable that the clinical manifestations described for this group exposure arose not from cyanide but from the detoxification product thiocyanate. Thiocyanates were popular some years ago as a therapeutic agent in the control of hypertension. The margin between therapeutic efficiency and toxic effect was so narrow that their use was ultimately discouraged and finally abandoned. A number of reports[6, 7] emphasize the toxicity of the

thiocyanates and the manner in which the number and severity of the toxic responses parallel the level of serum thiocyanate concentration. With serum thiocyanate concentration of less than 12 mg % one may expect complaints, including weakness, fatigue, exhaustion, somnolence, apprehension, nausea, diarrhea, abdominal pain, a variety of skin eruptions, and some tendency to develop thyroid dysfunction. When the level of serum thiocyanate exceeds 12 mg % the magnitude and severity of complaint increases to include angina, bleeding from mucous membranes, motor irritability, confusion, delirium, convulsions, and later paralyses, coma, and death due to central failure.

Practically all the members of this exposed group exhibited evidence of thiocyanate intoxication. It is interesting to note that tissue cyanide recovery in the case of the single fatality S.B. indicated a zero concentration for the liver. This probably reflects the high concentration of rhodanese in the liver as compared with other organs, where lower concentrations of rhodanese permitted some cyanide accumulation. The data for P.C. exhibit an interesting sidelight in the persistence of the levels of blood cyanide as compared with other members of the group whose blood cyanide rapidly dropped to zero concentration. It is known that the detoxification or conversion of cyanide to thiocyanate is impeded in the presence of hyperthyroidism, and P. C. did exhibit this associated finding.

If one discounts the effect of litigation, either actual or anticipated, upon the persistence and protraction of complaint, it would seem that subjective complaint when once established persists well beyond the point at which the serum thiocyanate returns to normal.

Summary

A clinical study of accidental organic cyanide exposure is presented. The emphasis on safe handling of potentially toxic materials is brought into clear focus by the demonstration of how disaster may follow when innovations which ignore the principles of safe handling are introduced into an operation otherwise safely conducted. The manifestations of toxicity would seem to come about, not from the primary or inherent toxicity of the offending agent, but rather from the natural detoxification mechanism which if not overwhelmed is intended to protect the host.

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References

1. Grabois, B.: Fatal Exposure to Methyl Cyanide, *Monthly Review, Division of Industrial Hygiene, New York State Department of Labor* 34:1, 1955.

2. Williams, R. T.: Detoxification Mechanisms, New York, John Wiley & Sons, Inc., 1949.

3. Wood, J. L., and Cooley, S. L.: Detoxification of Cyanide by Cystine, *J. Biol. Chem.* 218:1, 1956.

4. Voegtlin, C.; Johnson, J. M., and Dyer, H. A.: Biological Significance of Cystine and Glutathione (1) On the Mechanism of the Cyanide Action, *J. Pharmacol. & Exper. Therap.* 27:467, 1926.

5. Pozzani, U. C., and Nair, J. H.: Article presented at the Annual Meeting of the American Industrial Hygiene Association, Buffalo, New York, 1955.

6. Kessler, D. L., and Hines, L.: Hazards of Thiocyanate Therapy in Hypertension, *J.A.M.A.* 138:8, 1948.

7. Wald, M. H.; Lindberg, H. A., and Barker, M. H.: The Toxic Manifestations of the Thiocyanates, *J.A.M.A.* 112:12, 1939.

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AN INVESTIGATION OF THE

Mammalian Toxicity of Acetonitrile

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ACETONITRILE, methyl cyanide, CH_3CN, is attracting considerable interest as a volatile solvent, as a starting material for the synthesis of many organic compounds and as an extractant for animal and vegetable oils.

Little work of a toxicological nature has been reported on the solvent, although the early literature on its pharmacologic and physiologic properties stems from the 19th century. Giacosa, in 1883, claimed that acetonitrile was converted into acetic acid and ammonia in the dog.[1] Lang's work in 1894, however, led him to conclude that acetonitrile was converted into formate and cyanide.[2]

Minimum lethal dose (MLD) values, usually defined as the smallest of several dosages which kills any of a group of test animals, of 130 mg/kg and 105 mg/kg have been reported for rabbits after subcutaneous injections of acetonitrile,[3, 4] and 700 mg/kg and 600 mg/kg for mice after subcutaneous injections.[5, 6] Cuny and Quivy reported a *median lethal dose* (LD_{50}) of 5 ml/kg for the very pure solvent when it was injected subcutaneously into rats and suggested that impure material might be much more toxic.[7] Smyth and Carpenter published LD_{50} values of 3.8 gm/kg by gastric intubation to male rats, 5 ml/kg by cutaneous application to rabbits, and that inhalation of 8,000 ppm acetonitrile vapor killed one of six rats in four hours.[8] Since then it has been found that undiluted acetonitrile will pass slowly through the plastic sheeting like that originally used to retain the cutaneous applications and in reality is almost four times as toxic when impervious sheeting is used.

Acetonitrile may be characterized as follows: molecular weight 41.05, boiling point 81.6°C at 760 mm, specific gravity of 0.7839 20°C/20°C., vapor pressure of 73 mm at 20°C, refractive index of $1.34596_D^{16.5°C}$ and infinite water solubility. Air saturated with acetonitrile at 20°C and 760 mm contains approximately 96,000 ppm of vapor. At 25° C and 760 mm, 1 ppm = 0.001679 mg/liter, or 1 mg/liter = 595.3 ppm. The samples used in the following studies were obtained from the Union Carbide Chemicals Company, a division of Union Carbide Corporation, 30 East 42nd Street, New York 17.

Single Dose Studies

LD_{50} values for male and female Carworth Farms-Wistar or Nelson albino rats, in various assays over a five-year interval, ranged from 1.7 to 8.5 ml or gm/kg by gastric intubation (Table I). The males appeared to be two to four times as susceptible as females to undiluted acetonitrile by this route, but this difference was not important when the animals were fasted overnight before intubation. In many instances delayed deaths occurred at or above the LD_{50} dosage level. However, the highest dosage levels caused rapid deaths.

For a reason unexplained thus far, acetonitrile diluted in corn oil, water, or 1% aqueous Tergitol 7* is apparently better absorbed from the intestine and in most assays is somewhat more toxic for both male and female rats than is the undiluted compound. Yearling females must be regarded as an exception, as results for diluted and undiluted acetonitrile were identical.

From the Mellon Institute, Pittsburgh, and Union Carbide Corporation, New York.

A preliminary report on a portion of the work described in this article was given at the Annual Meeting of the American Industrial Hygiene Association, Buffalo, April, 1955.

Mr. Pozzani, Mr. Weil, and Dr. Palm are Senior Industrial Fellows and Dr. Carpenter is Assistant Administrative Fellow, Chemical Hygiene Fellowship, Mellon Institute, Pittsburgh. Mr. Nair is with Syracuse University Research Corporation, Syracuse, N. Y.

*Trademark of Union Carbide Corporation.

Table I—Summary of Response of Animals to Single Doses of Acetonitrile

Date	Route	Species	Sex	Weight Range, gm	1 ml = X gm	LD_{50} and Range
10/21/52	Gastric	Rats	M	90-120	Undil.	1.68 (1.24 to 2.27) ml/kg
11/24/53	Gastric	Rats	M	90-120	0.1 in H_2O	2.46 (1.60 to 3.78) gm/kg
2/2/54	Gastric	Rats	F	30-54 (weanlings)	0.1 in 1% Tg.	2.23 (1.90 to 2.62) gm/kg
12/13/56	Gastric (fasted)	Rats	M	84-114	Undil.	4.47 (2.79 to 7.16) ml/kg
3/8/54	Gastric	Rats	F	240-425 (yearlings)	0.1 in 1% Tg.	4.49 (2.46 to 8.21) gm/kg
4/29/54	Gastric	Rats	F	90-112	0.1 in 1% Tg.	2.34 (2.03 to 2.70) gm/kg
6/9/54	Gastric	Rats	F	90-120	0.1 in corn oil	1.73 (1.10 to 2.72) gm/kg
8/25/55	Gastric	Rats	F	90-114	Undil.	8.53 (6.12 to 11.9) ml/kg
5/17/56	Gastric	Rats	M	91-120	Undil.	2.07 (1.34 to 3.22) ml/kg
5/24/56	I.P.	Rats	F	90-117	Undil.	7.96 (5.08 to 12.5) ml/kg
10/16/56	Gastric	Rats	F	250-318 (yearlings)	Undil.	4.49 (2.45 to 8.21) ml/kg
12/20/56	Gastric (fasted)	Rats	F	82-109	Undil.	6.69 (4.11 to 10.9) ml/kg
9/2/58	Gastric	Rats	M	90-120	Undil.	4.49 (1.81 to 11.16) ml/kg
7/31/52	I.P.	Rats	F	90-110	0.1 in saline	5.62 (5.45 to 5.80) gm/kg
5/14/54	I.P.	Rats	F	90-155	Undil.	0.85 (0.61 to 1.19) ml/kg
12/30/54	I.P.	Rats	F	90-115	0.1 in saline	3.89 (2.43 to 6.23) gm/kg
5/24/56	I.P.	Rats	F	94-113	Undil.	0.95 (0.58 to 1.54) ml/kg
7/24/56	I.P.	Mice	M	20-28	0.1 in saline	0.25 (0.17 to 0.37) gm/kg
5/14/54	I.V.	Rats	F	90-120	Undil.	1.68 (1.19 to 2.39) ml/kg
10/15/56	I.V.	Rats	M	90-120	Undil.	1.68 (0.88 to 3.21) ml/kg
3/11/58	Gastric (fasted)	G. Pigs	M	476-1080	Undil.	0.177 (0.093 to 0.33) ml/kg
11/11/58	Skin	Rabbits	M	2158-2740	Undil.	1.25 (0.84 to 1.85) ml/kg
11/4/58	Skin	Rabbits	M	2264-2820	0.75 ml in H_2O	0.50 (0.37 to 0.67) ml/kg

*Tg. = Tergitol 7 in water.

Contrary to the usual order of events, we found that undiluted acetonitrile was somewhat more toxic by intraperitoneal injection than by the intravenous route. The difference in toxicity was slight but the reversal in the anticipated order of events was significant, and we therefore directed attention to them.

Much deliberation led us to the following tentative hypothesis. Intravenous injection by tail vein in the rat results in the undiluted acetonitrile reaching the blood locally in hemolytic concentrations. Some of the erythrocytes are lysed, but at the LD_{50} dosage the acetonitrile is diluted rapidly to the order of 5%, which is a nonhemolytic concentration. As the blood circulates through the lungs before reaching the liver some undetermined amount of acetonitrile escapes through the capillaries in the lung and is exhaled. The blood then travels on through the circulatory system to the liver, where many essential metabolic processes occur. Undiluted acetonitrile upon intraperitoneal injection bathes many of the abdominal organs and consequently all of the portal circulatory system. Therefore, if we assume the acetonitrile penetrates the naked liver, blood vessels, and those tissues which are drained directly by the portal circulatory system, it follows that the chemical may reach the liver in sufficiently high concentration to inhibit or perhaps destroy any given enzyme system in this organ and thus interfere with its normal functions. An important difference between the two routes may be that the intraperitoneal route delivers a high and damaging concentration promptly to the liver with little dilution while a circuitous route and immediate dilution is afforded by the intravenous injection.

The simplest experimental approach to test the hypothesis seemed to be the determination of the LD_{50} for rats by direct injection of acetonitrile into the portal vein. To accomplish this a laparotomy was performed with the rat under intraperitoneal pentobarbital sodium anesthesia and acetonitrile was injected. It was established by us that the intraperitoneal dosage of pentobarbital sodium used above did not influence the intravenous LD_{50} of undiluted acetonitrile when injected into the tail vein. Only animals that died without evidence of hemorrhage or lung infection were considered as deaths referable to acetonitrile. A series of controls were run with injections of equivalent volumes of 0.75% NaCl to validate the technique before the assay was attempted. The LD_{50} for the undiluted acetonitrile by portal vein was 0.71 (0.57 to 0.89) ml/kg, in contrast to 1.68 ml/kg via tail vein injection. In our opinion this result lends some credence to, but does not prove, the hypothesis that liver enzymes could have been poisoned by rapid penetration of the chemical when administered intraperitoneally.

Acetonitrile has an LD_{50} by rabbit skin penetration of 1.25 (0.84 to 1.85) ml/kg of the undiluted compound applied under polyethylene sheeting. It is of interest to note that the toxicity of acetonitrile by skin penetration is increased when application is made as a 75% (v/v) aqueous solution. The LD_{50} is 0.50 (0.37

to 0.67) ml/kg of the 75% aqueous solution. This ability of acetonitrile to penetrate skin does not weaken the hypothesis concerning penetration into the liver after intraperitoneal injection.

"Concentrated vapor," generated by bubbling dried air at 2.5 liters/min. through a fritted glass disc immersed in 50 ml of acetonitrile resulted in mortality ratios of three of six and none of six Carworth Farms-Wistar rats in 30 and 15 minutes respectively. Saturated vapor of the liquid would approximate 96,000 ppm at room temperature, but the volatility of acetonitrile caused the temperature of the liquid phase to fall considerably during aeration and resulted in mean measured concentrations approximating 53,000 ppm.

Groups of Carworth Farms-Nelson rats as well as other laboratory animals were then allowed to inhale accurately metered concentrations of acetonitrile vapor for four- or eight-hour periods. The vapor was generated by the methods described in previous papers from this laboratory.[9, 10] Table II shows the proportions of animals dying to the number that inhaled the vapor. Prostration, usually followed by convulsive seizures, preceded death. Autopsy of victims quite often revealed marked to moderate pulmonary hemorrhage or congestion. Some survivors showed similar pulmonary damage, but to a less marked degree. Delayed deaths occurred in all species at the lowest concentrations which killed any of the animals.

Dogs appeared to be most resistant to the vapor, with rats, guinea pigs, and rabbits following in decreasing order. Male rats appeared to be more susceptible than the females to eight-hour inhalations of acetonitrile, but, curiously, there was no discernible difference between the sexes in their susceptibility to four-hour inhalations. There was a greater difference in individual susceptibility to the vapor in rats than in the other three species tested.

Table II—Mortality Ratios for Various Species After Single Periods of Inhalation of Acetonitrile

	Rat						
	8 Hours		4 Hours		G. Pig 4 Hours*	Rabbit 4 Hours Male	Dog 4 Hours Male
ppm.	Male	Female	Male	Female			
32,000	12/12	12/12	12/12	12/12	....	....	1/1
16,000	12/12	9/12	3/12	6/12	6/6	....	3/3
8,000	6/12	1/12	3/12	0/12	6/6	....	0/1
4,000	1/12	1/12	0/12	0/12	0/6	4/4	....
2,000	0/12	1/12	....	....	....	0/4	0/2
1,000	0/12	0/12	....	....	....	0/4	....
LC_{50}	7,551 (5,975 to 9,542)	12,435 (11,036 to 14,011)	16,000 (12,450 to 20,562)	16,000 (13,037 to 19,636)	5,655 (0)	2,828 (0)	....

*Both males and females were used, but were not equally distributed among the inhalation groups.

Repeated Inhalation Studies

Rats

Animal groups, each consisting of 15 male and 15 female Carworth Farms-Wistar rats, inhaled 655 ppm, 330 ppm, and 166 ppm acetonitrile vapor seven hours per day, five per week, for a total of 90 days. An appropriate control group inhaled heated dilution air under similar experimental conditions.

All rats, bred in our laboratory, were selected at random from a group of rats of similar age. Only those rats whose weights were within two standard deviations of the group mean were used. Food and water were withheld from the animals during the seven-hour inhalation periods, five days per week. At all other times the rats had access to water and Rockland rat diet (complete).

Animals were weighed weekly and at the termination of the study, at which time liver and kidney weights were also determined after exsanguination following section of the cervical cord. Portions of the kidney, liver, and lung from each survivor were taken for histological examination. Brain, pancreas, spleen, trachea, and testis were also sampled from a few animals at each inhalation level. These latter tissues were to be examined if deleterious effects were found in the kidney, liver, or lung.

Air was drawn from the 200 liter inhalation chambers at a rate of 125 liters/min. The apparatus used to prepare the vapor was similar to that descibed in an earlier report from this laboratory.[9] Acetonitrile concentration in the chambers was checked four times daily with a portable Zeiss interferometer. This instrument was calibrated by an adaptation of the analytical method for *acrylonitrile* vapor in air described by Jacobs.[11] No copper acetate was used, for polymerization of the acetonitrile was not a problem. The ammonia released by hydrolysis was distilled over (with water vapor) into a trap containing 50 ml of 4% boric acid until the total content of the trap approximated 200 ml. This was titrated with N/10 HCl against methyl red. An 800 ml Kjeldahl flask with a ground glass joint was used for hydrolysis and distillation. This chemical method of calibration resulted in a value of 66.5 ppm acetonitrile per interferometer division.

Brieger, Rieders, and Hodes[12] reported that the presence of thiocyanate in the urine of animals that inhaled *acrylonitrile* was an indication of the formation of cyanide in vivo. Because of this information, the urinary thio-

Table III—Summary of Response of Rats Which Inhaled Acetonitrile Vapor Seven Hours per Day for 90 Days

	Males		Females		Males			Females		
Concentration, ppm	655	0	655	0	330	166	0	330	166	0
Mean weight at start of inhalation study, Gm.	195.0	196.5	149.1	149.5	177.1	174.9	181.3	145.4	146.9	143.9
Mean body weight gain of survivors, Gm.	181.4	168.0	81.7	94.9	172.7	164.8	169.5	89.3	86.6	94.3
Liver weight as % of body weight	3.30	3.26	3.62	3.71	3.04	3.06	3.10	3.69	3.38	3.56
Kidney weight as % of body weight	0.64	0.62	0.68	0.69	0.65	0.68	0.67	0.69	0.67	0.69
Toxic deaths	0	0	0	0	0	0	0	0	0	0
Sets of tissues examined	12	15	15	14	13	14	13	13	14	14

None of the values above differed significantly from their corresponding control values, using a fiducial limit of $p = 0.05$.

cyanate excretion of rats repeatedly inhaling 330 and 166 ppm acetonitrile vapor was determined by the method of Chesley.[13] We adopted his method and used it for all the urinary thiocyanate determinations reported in this paper.

Hematocrit and hemoglobin values were followed in five female rats at the 655 ppm level and their control group four days prior to the start of the study and on the 35th, 72nd, and 89th inhalation days.

The mean concentrations of acetonitrile vapor in the three inhalation chambers were 655, 330, and 166 ppm, with corresponding standard deviations of 37, 15, and 12. The body weight gains and the organ weights of the rats which inhaled the above vapors did not differ significantly from the controls (Table III). Furthermore, the few deaths that did occur were attributable to extraneous infection, and their incidence was unrelated to concentration.

The tissues of the rats that survived the inhalation of acetonitrile for 90 days were examined microscopically. Of the 28 rats inhaling 166 ppm vapor, 1 had histiocyte clumps in the alveoli, and another had atelectasis. Only three cases of tissue abnormality were observed in the 26 rats inhaling 330 ppm of the vapor. These involved lung changes such as bronchitis, pneumonia, atelectasis, and histiocyte clumps in the alveoli. A small lung granuloma was found in 1 of the 29 rats which served as controls for these two inhalation levels.

Significant micropathology involving the kidneys, livers, and lungs occurred in the rats which inhaled 655 ppm acetonitrile. Of the 27 sets of tissue examined, lung sections from 10 animals showed transitory lesions which apparently could be charged directly to action of the chemical. They included alveolar capillary congestion and/or focal edema, often accompanied by bronchial inflammation, desquamation, and hypersecretion of mucus. Tubular cloudy swelling of the kidneys of eight rats and central cloudy swelling of the livers of seven rats were also observed. Statistical analysis showed that these lung, kidney, and liver effects occurred to a significantly greater degree than in the control animals with P-values of 0.001, 0.005, and 0.04, respectively. No lesions were found in the adrenals, pancreata, spleens, testes, and tracheas examined. Focal cerebral hemorrhage was observed in one of the five brains examined.

Some thiocyanate was excreted by the rats inhaling 330 and 166 ppm acetonitrile vapor, although the amount of thiocyanate excreted was not proportional to the concentration of acetonitrile inhaled (Table IV). The urinary thiocyanate apparently was not excreted entirely during the 17-hour rest period between inhalation periods but was virtually all excreted during the 2.5 day rest period over the week end. The hematocrit and hemoglobin values of the five female rats inhaling 655 ppm acetonitrile did not differ significantly from the controls.

Monkeys and Dogs

Preliminary repeated inhalation studies were performed with four Rhesus monkeys. Animals 77712, 86908, and 86807 had previously been injected intravenously with sublethal amounts of acetonitrile and sodium thiocyanate but were rested for three months prior to these inhalation studies.

Table IV—Milligrams of Thiocyanate Ion (SCN^-) per 100 ml of Urine in 16-Hour Samples from Rats which Inhaled Acetonitrile

Conc. ppm.	No. of Rats Contributing to Sample	Sample Collected After x Inhalation Days				
		59*	60	61	62	(3 Days Rest)
330	29	34	45	60	29	0
166	28	17	27	79	74	0

*The rats were rested two days before the 59th inhalation day.

None of the four monkeys experienced an appreciable weight-loss during their respective inhalation periods. The monkey at the highest concentration, 2,510 ppm, appeared normal after the first inhalation day but showed poor coordination followed by prostration and labored breathing during the second inhalation day. Death occurred a few hours later.

Poor coordination was first observed in both monkeys during the second inhalation week at the 660 ppm level. Monkey 77712 vomited before death, on the 23rd inhalation day. The monkey which inhaled 330 ppm acetonitrile exhibited overextension reflexes and considerable excitability toward the end of its 99-day inhalation period. In conjunction with the above symptoms it is interesting to note that these same three animals on gross examination showed focal dural or subdural hemorrhage in the parietal and/or occipital tissues immediately adjacent to the superior sagittal sinus. Engorgement of the dural capillaries and pleural effusion were found in the female which died at the 2,510 ppm level.

Tissues from Monkey 86908, which inhaled 2,510 ppm, were not examined microscopically because some autolysis occurred before autopsy. Examination of the tissues from Monkeys 77712 and 90097, which inhaled 660 ppm, revealed focal areas of emphysema and atelectasis with occasional proliferation of alveolar septa. Focal cloudy swelling of the proximal and convoluted tubules of the kidneys was seen. The dura mater of Monkey 90097 had congestion of the meningeal vessels. Monkey 86807, which inhaled 330 ppm vapors, had chronic pneumonitis as evidenced by diffuse proliferation of alveolar septa, monocytic infiltration, and pleural adhesions. The cause of death of Monkeys 77712 and 90097 was not explained by the lesions observed in the tissues examined microscopically.

350 ppm Acetonitrile Vapor

Three adult male Rhesus monkeys, two male Basenji-Cocker hybrid dogs, and one male Basenji-Chow X Springer Spaniel hybrid dog between three and four years of age inhaled acetonitrile vapor five days per week, seven hours per day for 91 days. The inhalation chamber was a 7,900 liter cube from which air was exhausted at approximately 1,400 liters/min. Liquid acetonitrile was delivered at a constant rate from a dual syringe feeder* into an electrically heated spirally corrugated tubular Pyrex evaporator. The resultant vapor was then conducted into the chamber under slight negative pressure. The lack of animal housing facilities precluded the employment of an air-inhalation control group. This situation rendered the Zeiss interferometer useless as a means for checking daily concentrations, for the water vapor exhaled by the animals caused spuriously low readings on the instrument. Therefore, the daily inhalation concentrations were estimated from the amount of liquid acetonitrile consumed and the mean daily dilution airflow.

Table V—Response of Monkeys to Acetonitrile Vapor During Preliminary Repeated Inhalation Studies

Monkey Number	Sex	Conc., ppm.	Inhalation Days, 7 Hr. Each	Fate
86908	F	2,510	2	Died
77712	F	660	23	Died
90097	F	660	51	Died
86807	M	330	99	Killed

The animals were weighed at least once a week and hematological determinations were made seven times prior to inhalation and four times during the 91-day inhalation period. Urinary thiocyanate excretion and blood cyanide levels were followed in each animal on each of five consecutive inhalation days and after two days rest. The blood cyanide values reported in this paper were all determined by the method described by Feldstein and Klendshoj.[14] Two additional male Basenji-Cocker hybrid dogs were used for hematological and weight controls.

All animals were killed at the end of the study by anesthetization with intravenous pentobarbital sodium followed by exsanguination from the carotids and jugulars. Color photographs of the viscera were taken, and approximately 20 different tissues were sampled for histological examination.

The mean concentration of acetonitrile vapor for the 91-day inhalation period as estimated from the daily dilution airflow and liquid acetonitrile consumption approximated 350 ppm. A statistically significant drop in the mean body weight of the dogs was observed on the third and fifth inhalation days. Similar deviations were noted on eight other weighings up to the 72nd inhalation day. The weight response of the monkeys was not dramatic. Monkeys 96645 and 97020 showed over-all weight increases of 5% and 17% respectively over their original weights, and Monkey 96647 showed a 7% loss during the inhalation period. The hematocrit and hemoglobin values of the three dogs were depressed the fifth week of inhalation, but with the exception of Dog 70897, there was a return to preinhalation values toward the end of the 91-day inhalation period.

*Manufactured by Modern Metalcraft, Midland, Mich.

The depressions in the above values were not accompanied by any significant deviation in the erythrocyte counts. Monkey 96647 showed a significant increase in erythrocyte count throughout the study. No significant deviation from pre-inhalation neutrophil or lymphocyte counts was noted in any of the dogs or the monkeys.

The most dramatic tissue changes observed grossly at autopsy consisted of the occurrence of slight to moderate hemorrhage of the superior and inferior sagittal sinuses in the brains of all three monkeys. Small discrete caseous nodules were seen in the lungs of two monkeys, as well as a pale liver in one of these two. No significant gross pathologic change was seen in the dogs. Microscopic examination of tissues showed inhalation of 350 ppm acetonitrile vapor for 91 seven-hour inhalation periods by monkeys caused focal emphysema and diffuse proliferation of alveolar septa. Acute bronchitis was observed in one animal, and lung tissues from all three monkeys invariably contained focal accumulations of pigment-bearing macrophages. This intracellular pigment, presumably hemosiderin, was Turnbull blue positive. Apparently some of the congestion was due to pentobarbital sodium administered intravenously before exsanguination. Cloudy swelling of the convoluted kidney tubules, primarily proximal, was noted in two of the three monkeys. It should be pointed out that the grossly observed hemorrhage of sagittal sinuses was not seen in the single near midsagittal brain section viewed microscopically, because the affected areas were lost during processing of the tissues.

Histological examination of the tissues from the three dogs that inhaled 350 ppm acetonitrile vapors revealed some focal emphysema and proliferation of alveolar septa. The frequent appearance in various tissues of free and phagocyted pigment was presumably largely the result of congestion due to the use of pentobarbital sodium. The positive Turnbull blue reaction shown by the granules indicated they were hemosiderin.

Blood samples taken from the three monkeys which had rested two days prior to the 55th inhalation contained from 1.8 to 2.9 μg of cyanide per 100 ml. Blood samples taken after the 59th inhalation day following five consecutive inhalation days contained from 4.7 to 5.4 μg of cyanide per 100 ml. No detectable amounts of cyanide were found in the blood of dogs before the 35th inhalation day after two days rest, but 7.6 to 9.2 μg of cyanide per 100 ml were found after the 39th inhalation day after five consecutive inhalation days.

Table VI—Milligrams of Thiocyanate Ion per 100 ml Urine in 16-Hour Samples Collected from Monkeys Inhaling 350 ppm Acetonitrile Vapor

Inhalation Day	45*	46	47	48	49	Sat. Morn.
Monkey Number						
96647	14.5	20.1	10.5	17.4	17.4	26.1
96645	16.5	7.1	7.1	10.7	10.5	12.5
97020†	3.1	4.7	0.4	2.0	2.9	....
Mean	11.4	10.7	6.0	10.0	10.3	19.2

*These samples were collected during the second day of a two-day rest period.

†Monkey 97020 had five fewer inhalation days than the other monkeys, but this was not considered to be the reason for the lower values.

Table VII—Milligrams of Thiocyanate Ion per 100 ml Urine in 16-Hour Samples Collected from Dogs Inhaling 350 ppm Acetonitrile Vapor

Inhalation Day	35*	36	37	38	39	Sat. Morn.	40*
Dog Number							
70896	....	8.7	6.5	15.8	26.8	12.9	15.6
70897	11.6	4.7	6.7	9.6	16.5	20.3	....
57907	2.2	7.4	6.9	23.2	32.1	24.3	....
Mean	6.9	6.9	6.7	16.2	25.2	19.2	....

*These samples were collected on the second day of a two-day rest period.

There was some tendency for thiocyanate to accumulate in the urine of the dogs over a consecutive five-day inhalation period. However, detectable amounts of the metabolite were still present in both the dogs and the monkeys after two days of rest (Tables VI and VII).

Fate of Acetonitrile in Vivo

The preceding studies have demonstrated the formation of cyanide and thiocyanate in dogs and monkeys after repeated inhalation of 350 ppm acetonitrile vapor. The blood of rats repeatedly inhaling 330 and 166 ppm acetonitrile was not analyzed for cyanide, but the formation of the metabolite was indicated by the presence of variable amounts of thiocyanate in the urine of these animals. Thiocyanate was also found in the urine of rabbits inhaling 2,000 and 4,000 ppm vapor for single four-hour periods.

In order to obtain information as to how much cyanide is actually formed in the mammalian body after inhalation of lethal concentrations of acetonitrile, three mongrel dogs were allowed to inhale 16,000 ppm vapor for a total of four hours. The animals were taken from the inhalation chambers for three minutes at approximately hourly intervals for bleeding.

Table VIII—Micrograms of Cyanide Ion per 100 ml Blood from Dogs Inhaling 16,000 ppm Acetonitrile Vapor for a Total of Four Hours

Min. After Start of Inhalation Period	Dog 94938	Dog 95279	Dog 95278
20	....	11	....
60 - 65	43	53	33
120 - 135	125	179	149
184 - 195	433	397	305
245 - 250	266	291	290
*			
320 - 345	250	168	247
415	211	....	....
485 - 500	196	....	458

*Dashed line represents the end of the inhalation period, which totaled four hours.

All animals died within 14 hours after termination of inhalation. Considerable amounts of blood cyanide were found in the dogs during the inhalation period (Table VIII). It was interesting to note that the blood cyanide level in each dog began to fall before the end of the inhalation period. In view of the consistency of the other data, the high value found for Dog 95278 at 485 minutes reasonably may be considered an analytical artifact.

The amount of acetonitrile actually absorbed by the animals in these inhalation studies was not known. It was reasoned that a better picture of the metabolism of acetonitrile could be obtained if the ratio between absorbed acetonitrile and thiocyanate excretion were known. Furthermore, it was desirable to know how much of the thiocyanate which was formed would be excreted.

Consequently three Rhesus monkeys were injected intravenously with sublethal doses of acetonitrile (0.1 ml/kg), and daily urinary thiocyanate excretion was followed for four to seven days when depletion occurred. These same monkeys were injected with 1.55 ml/kg of a 10% solution of sodium thiocyanate in normal saline four to eight weeks after the acetonitrile injection. Daily urinary thiocyanate excretion was again followed to depletion.

Table IX—Recovery of Urinary Thiocyanate Ion from Monkeys After Intravenous Injection of Acetonitrile and Sodium Thiocyanate

Monkey Number	Date Injected	Material Injected	Mg Thiocyanate Equiv. Injected	Mg Thiocyanate Excreted	% Recovery
77712 (F)	10/ 7/54	CH_3CN	473	82	17
86908 (F)	11/22/54	CH_3CN	642	76	12
86807 (M)	11/22/54	CH_3CN	473	38	8
				Mean =	12
77712 (F)	12/ 2/54	NaSCN	468	158	34
86908 (F)	12/20/54	NaSCN	544	403	74
86807 (M)	12/20/54	NaSCN	566	301	53
				Mean =	55

The mean percentage of thiocyanate recovered from the three monkeys injected with acetonitrile was approximately 12% (Table IX). Approximately 55% of the sodium thiocyanate injected was recovered as thiocyanate. Thus it appears that more than 12% of the acetonitrile was converted to thiocyanate, although the metabolite was not entirely excreted.

Human Inhalations

40 ppm Acetonitrile Vapor

Three men, PEP, UCP and CPC, between the ages of 31 and 47, inhaled 40 ppm acetonitrile vapor for four hours in a 7,900 liter chamber. Air was exhausted from the chamber at 1,400 liters per minute, and the ambient chamber air temperature was kept below a maximum of 76°F. The services of a physician were available during the inhalation period, and the subjects occupied themselves with conversation, writing, and recording subjective reactions. Neither PEP nor CPC was a user of tobacco.

The cyanide content of the blood of each subject was determined 19 days and 1 day prior to, and immediately after, inhalation. The thiocyanate content of 24-hour urine samples was determined 19, 18, and 1 day prior to the inhalation period and immediately after the inhalation period. Each sample consisted of two fractions: one taken between 8:00 a.m. and 4:00 p.m. and the other taken from 4:00 p.m. to 8:00 a.m. the following morning.

The two older subjects, CPC and UCP, reported no adverse subjective response during and after the four-hour inhalation period. There was no appreciable increase in urinary thiocyanate and no detectable blood cyanide. The youngest subject, PEP, reported no adverse subjective response during the inhalation period, but he did experience a slight tightness in the chest that evening. The following morning he also reported a cooling sensation in the lung similar to that experienced when menthol is inhaled. This sensation persisted for approximately 24 hours. There was no detectable blood cyanide, but there was a slight increase in the urinary thiocyanate level for this subject. All three subjects detected the odor of acetonitrile for the first two or three hours, after which they experienced some olfactory fatigue. A hearty lunch was enjoyed by all immediately after the four-hour inhalation period.

80 ppm Acetonitrile Vapor

CPC and UCP then inhaled 80 ppm acetonitrile vapor for four hours one week after the 40 ppm trial. Blood cyanide levels were followed immediately before, and ½ hour, 3 hours, and 24 hours after the inhalation period. Urinary thiocyanate was determined one day before, and one and two days after inhalation.

The subjective response of both subjects was again negative. No blood cyanide was detected in any of the samples taken after the inhalation period. The urinary thiocyanate picture was confused, for UCP had a higher urinary thiocyanate value immediately before inhalation than he did afterward. On the other hand, CPC values were relatively constant.

160 ppm Acetonitrile Vapor

The same two subjects inhaled a metered concentration of 160 ppm acetonitrile vapor for four hours, nine days after the 80 ppm run. The blood cyanide and urinary thiocyanate levels were determined at the same time intervals as those for the 80 ppm inhalation run.

The only adverse subjective responses were reported by CPC, who experienced a slight transitory flushing of the face two hours after inhalation, and a slight feeling of bronchial tightness about five hours later. The latter symptom did not persist overnight. This subject had reported a slight nasal drip prior to the inhalation. The blood cyanide and urinary thiocyanate levels of both subjects did not change significantly from pre-inhalation values. Both subjects stated they would have no hesitation about inhaling 160 ppm acetonitrile vapor again for a four-hour period.

Discussion and Conclusions

Different animal species and individuals of the same species varied widely in susceptibility to acetonitrile in single-dose toxicity studies by various routes. These dissimilarities in response must be taken into consideration in estimating a permissible concentration for inhalation by humans. The inhalation of 655 ppm acetonitrile vapor by male and female rats for 90 seven-hour days produced no adverse effects on body weight-gains and organ weights, but significant tissue changes in the kidneys, livers, and lungs indicated that acetonitrile was not "safe" for rats under these conditions.

The marked lung congestion and pleural effusion were severe enough to be considered the primary cause of death of the monkey which succumbed to 2,510 ppm acetonitrile vapor. The lesions observed in the viscera of two monkeys which inhaled 660 ppm vapor were not sufficiently severe to account for their fatalities.

Although there were some statistically significant hematological changes in the dogs and monkeys which inhaled 350 ppm acetonitrile vapor for 91 seven-hour days, these changes were not dramatic. The fact that tissue lesions as well as other criteria of toxic stress were observed in these same animals suggests that hematological testing of humans as an indication of chronic acetonitrile poisoning would not be feasible. The absence of significant hematological changes in rats in which adverse tissue changes occurred after inhaling 655 ppm vapor for 90 days corroborates the above suggestion.

It was difficult to evaluate the significance of the maximum of 9.2 μg of cyanide/100 ml blood of the dogs and monkeys repeatedly inhaling 350 ppm acetonitrile vapor. Brieger and co-workers reported a mean of 0.51 micromoles cyanide/100 ml blood (13.3 μg cyanide/100 ml) from four dogs inhaling 50 ppm *acrylonitrile* for seven hours.[12] Sporadic brain lesions characteristic of anoxia occurred in Brieger's animals and in ours. No blood cyanide, by the method of Feldstein and Klendshoj[14] was found in our laboratory in several untreated dogs and monkeys and in humans prior to and after inhaling a maximum of 160 ppm acetonitrile vapor for four hours.

Gettler and Baine reported the presence of 1,711 and 500 μg of HCN per 100 ml of blood from dogs which inhaled fatal concentrations of HCN for 12 and 8 minutes respectively.[15] These concentrations are comparable to the peak concentrations of 305 to 433 μg of cyanide ion per 100 ml of blood from our dogs which inhaled a fatal concentration of 16,000 ppm acetonitrile. Therefore, it appears that the death of these dogs was caused, at least in part, by the formation of cyanide in vivo. However, it cannot be maintained that acetonitrile causes death under all conditions and at all concentrations because of the formation of cyanide and other metabolites. Concentrations of 53,000 ppm acetonitrile, attained in the "concentrated vapor" test, killed rats in 30 minutes or less. High intravenous and gastric intubation dosages also caused rapid deaths. It is hardly possible that fatal amounts of cyanide could be formed in such short periods of time. It appears, therefore, that at high concentrations causing rapid death, acetonitrile kills by action of the intact molecule. At lower concentrations causing delayed deaths, cyanide and other metabolites play a more important role.

The determination of blood cyanide and urinary thiocyanate should not be relied upon as evidence of brief inhalation to low concentra-

Table X—Comparison of the Response of Animals to Vapors of Acrylonitrile and Acetonitrile

Ppm	Hr. × Days	Mortality Ratio			Ref.
		Dogs	Monkeys	Rats	
	Acrylonitrile				
100	7 × 1	6/6	....	4/20	12
75	7 × 1	3/4	1/3	0/20	12
50	7 × 1	0/4	....	0/20	12
110	4 × 1	2/3	....	....	17
100	4 × 1	0/3	....	....	17
90	4 × 1	....	0/2	....	17
65	4 × 1	1/2	0/4	....	17
30	4 × 1	0/3	....	....	17
635	4 × 1	....	....	16/16	17
315	4 × 1	....	....	5/16	17
130	4 × 1	....	....	0/16	17
1,000	4 × 1	....	....	6/6	18
500	4 × 1	....	....	0/6	18
153	4 × 25	....	....	12/16	16
153	4 × 30	....	1/2	....	16
100	4 × 40	....	....	0/16	16
56	4 × 20	1/2	0/4	....	16
	Acetonitrile				
32,000	4 × 1	1/1	....	24/24	
16,000	4 × 1	2/2	....	9/24	
8,000	4 × 1	0/1	....	3/24	
4,000	4 × 1	....	....	0/24	
2,000	4 × 1	0/2	....	....	
2,510	7 × 2	....	1/1	....	
660	7 × 23	....	1/1	....	
660	7 × 51	....	1/1	....	
655	7 × 90	....	....	0/28	
350	7 × 90	0/3	0/3	....	
330	7 × 90	....	....	0/26	
330	7 × 99	....	0/1	....	

tions of acetonitrile vapor. No blood cyanide was found in human subjects inhaling 40, 80, and 160 ppm vapor, and there was no correlation between thiocyanate excretion and acetonitrile concentration.

The variability of subjective responses of humans to 40, 80, and 160 ppm acetonitrile vapor suggests that, even if a concentration of the solvent vapor were selected that would not endanger the health of the majority of workers, it might cause discomfort to some.

Dudley and co-workers[16] proposed a tentative maximum permissible concentration of 20 ppm for *acrylonitrile* in 1942. This figure was derived from repeated animal studies and the relationship of the solvent to HCN, whose maximum permissible concentration was 20 ppm at that time.

A perusal of Table X will show that acetonitrile vapor has only a fraction of the toxicity of *acrylonitrile* vapor for animals. Both compounds cause a varied species response, and both cause the formation of cyanide in vivo.

Because of the above considerations and the fact that the permissible *acrylonitrile* concentration figure has withstood the test of time, it is reasonable to suggest an initial hygienic standard for acetonitrile vapor of no more than 40 ppm. This may be modified by human experience as data on acceptability and clinical evidence of safety are accumulated.

The authors are indebted to Miss Jean Striegel, Miss Naomi Condra, and Mr. George Keck for able technical assistance.

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References

1. Giacosa, P.: Sur la Transformation des Nitriles dans l'organisme, *Ztschr. physiol. Chem.*, Hoppe-Seyler's 8:95, 1883.

2. Lang, S.: Ueber die Umwandlung des Acetonitrils und seiner Homologen im Thierkörper, *Arch. Exper. Pathol. Pharmakol.* 34:247, 1894.

3. Verbrugge, R.: Toxicité des mononitriles gras et aromatiques et action antitoxique de l'hyposulfite de soude vis à vis de ces mononitriles, *Arch. internat. Pharmacodyn.* 5:161, 1899.

4. Rentz, E.: Detoxification of Nitriles, *Arch. Internat. Pharmacodyn.* 36:455, 1929.

5. Hunt, R.: Cyanwasserstoff Nitril Glukoside, Nitril Rhodanwasserstoff Isocyanide, Heffter's *Handbuck der Experimentelle Pharmakologie, Vol. 1*, No. 1, p. 812., 1945. (Lithographed by Edward Bros., Ann Arbor, Mich.)

6. Wiesbader, H.: Reid Hunt Reaction and the Thyrotropic Hormone, *Endocrinol.* 20:100, 1936.

7. Cuny, L., and Quivy, D.: Toxicity of Acetonitrile for Rats, *Compt. rend. Soc. biol.* 132:429, 1932.

8. Smyth, H. F., Jr., and Carpenter, C. P.: Further Experience with the Range Finding Test in the Industrial Toxicology Laboratory, *J. Indust. Hyg. & Toxicol.* 30:63, 1948.

9. Carpenter, C. P.; Smyth, H. F., Jr., and Pozzani, U. C.: The Assay of Acute Vapor Toxicity and the Grading and Interpretation of Results on 96 Chemical Compounds, *J. Indust. Hyg. & Toxicol.* 31:343, 1949.

10. Pozzani, U. C.; Weil, C. S., and Carpenter, C. P.: Subacute Vapor Toxicity and Range-Finding Data for Ethyl Acrylate, *J. Indust. Hyg. & Toxicol.* 31:311, 1949.

11. Jacobs, M. B.: Industrial Poisons, Hazards and Solvents, Ed. 2, New York, Interscience Publishers, 1949, p. 460.

12. Brieger, H.; Rieders, F., and Hodes, W. A.: Acrylonitrile: Spectrophotometric Determination, Acute Toxicity, and Mechanism of Action, *A.M.A. Arch. Indust. Hyg.* 6:128, 1952.

13. Chesley, I. C.: The Determination of Thiocyanate in Biological Fluids, *J. Biol. Chem.* 140:135, 1941.

14. Feldstein, M., and Klendshoj, N. C.: The Determination of Cyanide in Biologic Fluids by Microdiffusion Analysis, *J. Lab. & Clin. Med.* 44:166, 1954.

15. Gettler, A. O., and Baine, J. O.: The Toxicology of Cyanide, *Am. J. M. Sci.* 195:182, 1938.

16. Dudley, H. C.; Sweeney, T. R., and Miller.: J. W.: Toxicology of Acrylonitrile (Vinyl Cyanide), II. *J. Indust. Hyg. & Toxicol.* 24:255, 1942.

17. Dudley, H. C., and Neal, P. A.: Toxicology of Acrylonitrile (Vinyl Cyanide), I. *J. Indust. Hyg. & Toxicol.* 24:27, 1942.

18. Smyth, H. F., Jr., and Carpenter, C. P.: Further Experience with the Range Finding Test in the Industrial Toxicology Laboratory, *J. Indust. Hyg. & Tox.* 30:63, 1948.

Radiation Protection--Standards and Laws

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MAN'S struggle for dominance on this planet has been accompanied by a series of hazards, each of which he has learned to control. This started before the dawn of history when the greatest problem was avoiding the saber-toothed tiger and other predators. As civilization advanced, his weapons and teamwork made him master of these obvious enemies, but he fell prey to the many diseases which flourished in the towns and cities which he built to best exploit his abilities to perform work together. As these problems were solved by modern medicine, a new class of problems developed because of the hazards inherent in a highly technological society using mechanical devices and exotic chemicals. It is of interest to note, however, that the solution of each of these problems added years to the life span of man, so that the present standards are among the highest in history.

Among the possible hazards of our present civilization is the increase in radiation and radioactive materials from a multitude of uses, ranging from the generation of power to complex scientific investigations of the life processes themselves. These radiations can provide actual hazards only if we permit indiscriminate and uncontrolled use by groups or individuals who are unconcerned with either their own or others' safety. Our present solution to this problem of control is in standards and codes which are designed to permit maximum utilization while still maintaining adequate controls on the exposure of people and other life forms upon which man is dependent.

The problem, then, is to provide standards and codes which will permit the desired latitude in action but will, if followed, ensure the safety of both the population and the individual. An auxiliary problem is to see that these rules of good conduct are followed.

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The history of the discovery of radiation and radioactive materials followed by various types of injury and individual recommendations for limits has been reviewed many times. This paper will briefly review some of the organizations active in the formulation of standards and the evolution of laws for radiation protection in this country. No attempt has been made to make this a comprehensive treatise. Many important contributions have been deliberately eliminated in favor of providing a survey of the activity in these areas.

International Commission on Radiological Protection

The original studies of radiation protection and definition of units fell to the radiologists, since the majority of the early uses of radiation were in the diagnosis and treatment of various human disorders. While many individuals had recommended limits for exposure of people because of adverse effects, the first organized efforts for formulating limits arose in England with the British X-Ray and Radium Protection Committee. Several years later, in 1928, the International Commission on Radiological Protection (ICRP) was formed under the auspices of the Second International Congress of Radiology. This group adopted protection criteria similar to those submitted by the British group and further recommended the formation of a central group in each country for the purpose of consolidating national submissions.[1]

National Committee on Radiation Protection and Measurements

As a result of the ICRP recommendation, the Advisory Committee on X-Ray and Radium Protection was established in the United States. This independent group of experts with representatives from interested societies and organizations, under the sponsorship of the National Bureau of Standards, was the forerunner of the present day National Committee on Radiation Protection (NCRP).

The efforts of the NCRP were and are devoted to the formulation of recommendations to be applied on a voluntary basis by individuals or groups. These recommendations are published as National Bureau of Standards Handbooks. The success of the Committee's efforts has depended on the establishment of recommendations of good practice, which carry weight primarily because of the caliber of the individuals involved.

As might be expected, the first publications of the NCRP were concerned with x-ray protection and radium protection. Handbook 15, "X-Ray Protection," was published in May, 1931, and Handbook 18, "Radium Protection for Amounts up to 300 mg" was published in 1934. These Handbooks were revised and reissued as Handbook 20 in 1936 and Handbook 23 in 1938, respectively. The two handbooks were widely accepted in this country and used by the Manhattan Engineering District as primary guides for radiation protection during the war years.[2]

In 1947, as a result of new data which had become available and the growing complexity of radiation protection problems, the NCRP broadened its scope and enlarged its membership. From an initial organization of five participating organizations and eight members, today the main committee of the National Committee on Radiation Protection includes about 50 members representing about 20 organizations.

In total the NCRP has published 19 handbooks which provide the basic recommendations for radiation protection in the United States.

Both the NCRP and the ICRP are continuing their study of the problems involved with exposure of both workers and the general public. The detailed work is carried out by subcommittees, many of which have common representation on the two bodies. An indication of the type of studies being carried out is the following list of the present subcommittees of the NCRP.

1. Permissible dose from external sources
2. Permissible internal dose
3. X-rays up to two million volts
4. Heavy particles (neutrons, protons, and heavier)
5. Electrons, gamma rays, and x-rays above two million volts
6. Handling of radioactive isotopes and fission products
7. Monitoring methods and instruments
9. Protection against radiation from RA, Co^{60}, and Cs^{137} encapsulated sources
10. Regulation of radiation exposure dose
11. Incineration of radioactive wastes
12. Electron protection
13. Safe handling of bodies containing radioactive isotopes
14. Permissible exposure dose under emergency conditions

American Standards Association

The American Standards Association (ASA) has within recent years organized groups to study problems in the nuclear industry and to investigate areas wherein standardization of practice would be useful. The Association provides for a balanced committee of manufacturers, distributors, consumers, technical specialists, and others directly concerned to prepare standards. If a proposed standard represents a national consensus, ASA then recognizes it as an "American Standard."

The scope of the work of subcommittees of the Nuclear Standards Board of the ASA involved in radiation protection subjects is indicated by a list of these subcommittees.

N2 General and administrative standards
1. Color codes and symbols
2. Procedures for industrial exposure records
3. Qualifications of nuclear professionals
5. Model atomic energy legislation

N5 Chemical engineering
2. Radioactive waste disposal
5. Packaging and transportation of radioactive material

N7 Radiation protection
1. Uranium mines and milk
2. Uranium and thorium refineries
3. Isotopic separations
4. Fuel element fabrication
5. Reactors

In addition, the work of Committee N6, Reactor safety standards, is closely related to many questions of radiation protection in emergency conditions.

Other Organizations

Although the preceding organizations and their studies have arbitrarily been classed as the ones with the major efforts in studies leading to recommendations, there are many other important groups studying both specific areas as well as more general problems involved in the expansion of atomic energy. A few of these groups will be mentioned because of their past or expected future efforts in the broader aspects of the problem.

The United Nations has investigated the general problem of radiation effects through their Scientific Committee on Radiation. This group has produced an excellent survey of available information on the present radiation levels to which the general populace is exposed and on the effects of radiation on man.[3] Although no specific recommendations for control were made, the accumulated information will certainly be of great value to individuals or groups involved in radiation protection work.

The International Atomic Energy Agency (IAEA), although a relatively new organization, is making studies of the problems involved in each country. Their Health and Safety Group has issued a "Manual for Safe Handling of Radioisotopes." It is to be expected that the IAEA will continue their studies particularly on aspects such as transportation and waste disposal which involve more than one country.

The International Labour Organization (ILO) has been interested in radiation protection for several years. In 1949 it published a "Model Code of Safety Regulations for Industrial Establishments for the Guidance of Governments and Industry."[4] This code included maximum permissible exposures, records required and details on working conditions with specific recommendations for X-rays and radioactive materials. In general these recommendations were based upon the limits published by the ICRP and the NCRP, and are merely guides to the member nations. In June this year the ILO will consider more formal action for radiation protection.

Regulations

In the past few years there has been an increase in legislation designed to provide for control of radiation. Legislative action differs from formulation of recommendations in that compliance with rules and regulations adopted can be required and enforced by the governing body. For this reason the regulatory agencies have looked to the organizations preparing recommended standards for firm criteria so that compliance with regulations can be judged in the usual manner.

The passage of the Atomic Energy Act of 1954 imposed on the Atomic Energy Commission (AEC) responsibility for radiation protection of its licensees and its contractor personnel. To satisfy this requirement the AEC has produced a comprehensive set of regulations and procedures. Of particular interest is the Code of Federal Regulations, Title 10, Part 20, "Standards for Protection Against Radiation." This part specifies maximum permissible radiation doses, maximum concentration in waste, records and reports required, etc. The requirements generally follow the recommendations of the NCRP in those areas common to the two. These rules are drawn up in such a way that compliance would permit safe operation under any condition. For example, disposal of waste is limited at the point of discharge to the maximum permissible concentration for public use with no credit for dilution in streams. This covers the needs of most of the users so that no special attention is required. However, if a

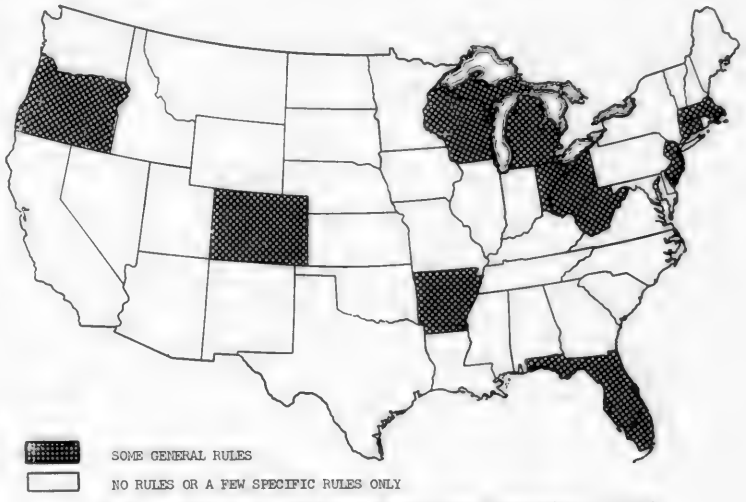

Fig. 1—Status of radiation protection, September 1, 1954.

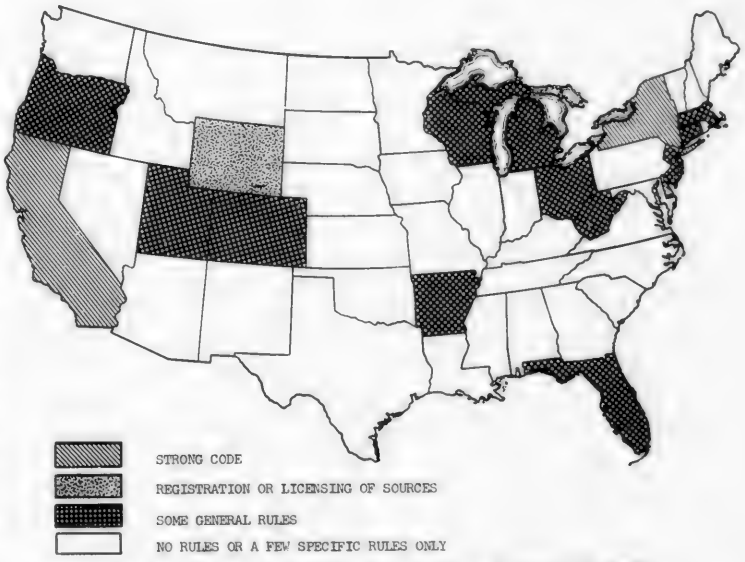

Fig. 2—Status of radiation protection, January 1, 1956.

particular group finds these rules too restrictive, procedures are available whereby the members can seek relief.

In addition to imposing health and safety responsibilities on the AEC, the Atomic Energy Act of 1954 enabled industry, educational institutions, medical and research organizations, and other groups to obtain and use nuclear fuel and byproduct material. This "release" of heretofore well-controlled material prompted state and local governments to examine existing codes and regulations for adequacy of coverage for radiation hazards. The review of the health aspects of radiation usage was a natural consequence of the states traditional role of providing for the health and welfare of its citizens.

In addition to a desire to continue this historical course of action, the states were encouraged to take regulatory steps by the public whose apprehension regarding radiation had been heightened by the sharp increase in the number of locations using radiation sources. Labor groups were also concerned about the new hazard and requested some type of rules to control radiation hazards in the work place. Further encouragement for action was provided when the results of a few state surveys revealed the large number of sources in use which were not controlled by the AEC (machine-produced isotopes, radium, and generating machines) fall outside the jurisdiction of the AEC.

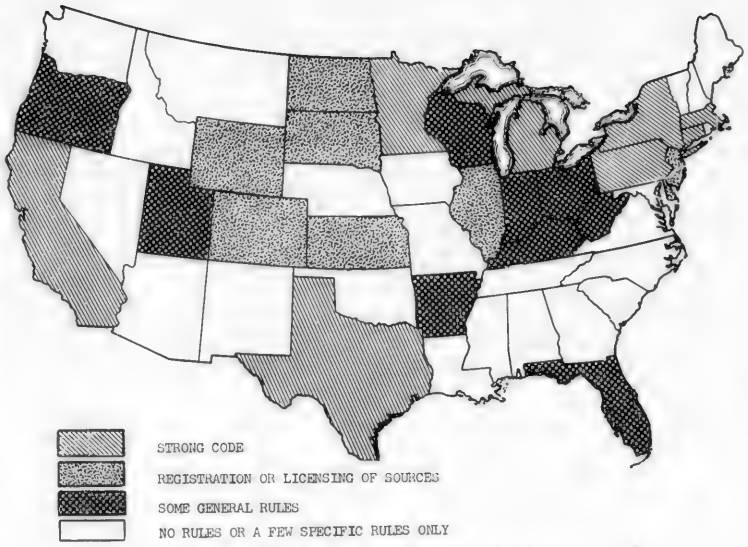

Fig. 3—Status of radiation protection, January 1, 1959.

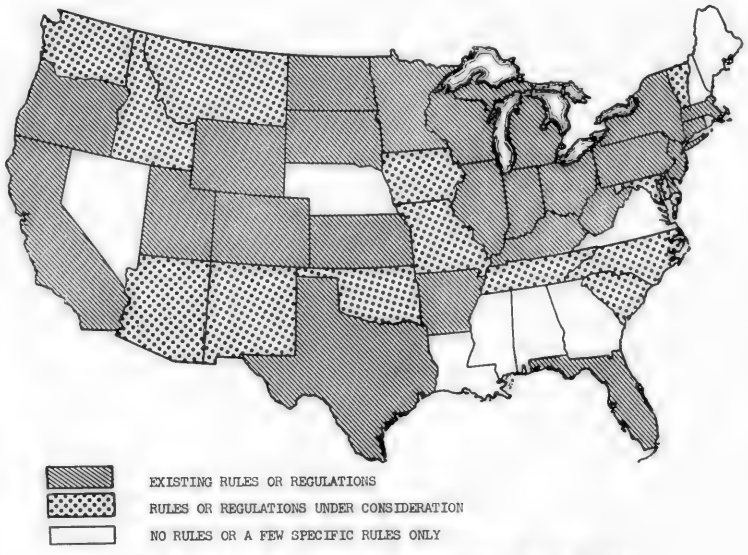

Fig. 4—Status of radiation protection, March, 1959.

The following figures will illustrate the action taken by the states regarding the control of sources of radiation (Figs. 1-4).

As of Sept. 1, 1954, 11 states had some type of general rules pertaining to the use of radiation sources. For example, in 1947, Florida's state Industrial Commission adopted Regulation No. 8, "Radiant Energy" which includes maximum standards for exposure and authorizes inspection of radiation installations by the State Board of Health.[5]

By Jan. 1, 1956, two states had adopted strong codes detailing limits, while two states passed radiation source licensing procedures.

By Jan. 1, 1959, regulatory action had been taken by some 25 states while by March of this year with most of the state legislatures in session all but 10 states either had some type of existing rules or regulations or were considering such action.

In many cases, the states have adopted one of the model bills, such as that recommended by the NCRP[6] or the American Public Health Association, or have adapted one of these models to their needs. To date, the regulations which have been promulgated include the rec-

ommendations of the NCRP for maximum permissible limits.

The continual increase in knowledge about radiation and its effects result in changes in the NCRP recommendations which are not immediately reflected in the regulations because of the time required to change laws and codes. Despite this time lag and the lack of definite criteria in certain areas, the state governments are becoming more aware of the problems. Efforts are being made to provide information and assistance to state industries and state technical personnel are acquiring the special skills required to assess hazards and take the necessary steps to eliminate them.

Conclusion

As has been emphasized earlier, not all the groups involved in providing recommendations or taking regulatory action for radiation protection have been covered in this paper. The role of the U.S. Public Health Service has not been mentioned, in spite of its many contributions to the philosophy and work in radiation protection. Similarly the significance of the studies of the National Academy of Sciences-National Research Council[7] and of the British Medical Research Council[8] on the formulation of standards was omitted.

Agencies of the federal government other than the AEC have adopted regulations for handling radioactive materials. For example, regulations of the Interstate Commerce Commission include procedures for interstate transport of radiation sources.

Within the states themselves more than one agency is involved in the promulgation of codes and regulations. This statement can also be extended to the level of the municipality where there are questions involving fire fighting, waste disposal to city sewers, location of facilities, etc.

As our knowledge of the effects of radiation increase, it is probable that many of the recommendations and codes will be revised to include more definitive standards.

The goal of maximum utilization of the developments possible from atomic energy with minimum hazards to both workers and the general public requires considerable foresight on the parts of the individuals responsible for the development of the recommendations or codes.

References

1. Taylor, L. S.: *Health Physics* 1:97-104 (Sept.) 1958.
2. Taylor, L. S.: *Health Physics* 1:3-10 (June) 1958.
3. Report of the United States Scientific Committee on the Effects of Atomic Radiation, New York, 1958.
4. International Labour Office: Report Submitted to the International Conference on the Peaceful Uses of Atomic Energy, Geneva, Switzerland, August, 1955.
5. Atomic Industrial Forum, Inc.: State Activities in Atomic Energy, June, 1958.
6. National Committee on Radiation Protection, U.S. Department of Commerce, National Bureau of Standards, Handbook 61, Dec. 9, 1955.
7. The Biological Effects of Radiation, National Academy of Sciences-National Research Council, Washington, D.C., 1956.
8. Medical Research Council: The Hazards to Man of Nuclear and Allied Radiation, Her Majesty's Stationery Office, CMD 9780, June 1956.

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Topical Review

Fluorides: A Critical Review

II. Analysis of Fluorides

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MUCH attention has been given to the analytical chemistry of fluoride, particularly in recent years, as a result of the increasing use of inorganic and organic fluoride in industry and agriculture. Investigations of the injurious effects exerted by the fluoride ion on vegetation and livestock, and of its role in the prevention of dental caries in children, have led to the development of numerous methods for the determination of trace quantities of fluoride in a great variety of materials. These methods have been the subject of a number of reviews,[12, 31, 33, 39, 56, 70] the most recent being that of Elving, Horton, and Willard.[31] This very comprehensive and critical paper lists 1,401 separate references to the analysis of all types of material containing fluorine, so that another review of the entire field at this time could add little that is new. However, since the quantitative analysis of organic material is difficult, frequently necessitating specialized pretreatment and handling of the material, this review will deal primarily with the status of the analytical procedures used to determine trace amounts of fluorine in biological and related material. No claim is made for the completeness of the references, which have been selected mainly as examples of representative publications. The basic steps in the determination of fluoride in biological material include the selection and handling of samples, and the concentration, isolation and estimation of the fluoride ion. Each step is discussed in detail in the following sections.

Sampling

The reliability of a finding depends partly upon the analytical method and partly upon the manner in which the sample has been collected and handled prior to its actual analysis. Too little attention is sometimes given these matters, and differences in analytical results due to incorrect sampling may be mistaken as evidence that the analytical method is at fault. The precautions necessary in the selection and sampling of material for analysis depend upon the objectives of an investigation and an understanding of the effects caused by a variety of factors that vary with the material. In air sampling, as well as in the sampling of vegetation in survey work, it is necessary to recognize that contamination may arise from a variety of sources. All evidence of such contamination should be noted, as well as such pertinent information as a description of the sample, the location of the sampling site, the season of the year, and prevailing weather conditions.[17]

In the case of vegetation, the concentration of fluoride varies in the root, stem, leaves, and fruit. Variations in the proportional representation of the different parts of the plant in a sample can produce a misleading finding and, therefore, judgment must be exercised in the selection of the specific portion of the material for analysis. An excellent discussion of the selection of samples in regard to the portion of the plant and the sampling errors that are related to the variability of the material has been given recently by Nichol and co-workers.[61]

Losses of fluorine through the formation of hydrogen fluoride, which may volatilize or which may react with the glass of a sample container to form volatile fluosilicic acid, must be prevented.[31, 79] Such losses become particularly significant if the sample must be stored for any appreciable length of time prior to analysis. In this connection, polyethylene containers are rapidly replacing glass vessels for storage of fluorine-containing material. The possible loss of hydrogen fluoride must also be considered in any treatment involving evaporation or heating. These losses are accelerated if acids are present,

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but can be prevented if the sample is maintained in an alkaline condition. A variety of fluoride fixatives have been employed, including sodium hydroxide, sodium carbonate, salts of magnesium and calcium, and certain compounds of aluminum and copper.[31, 53] Many of these can be used only for certain materials under special conditions, while others have been selected chiefly because of their low content of fluorine. Calcium oxide low in fluoride (1-3 ppm) is a satisfactory fixative for fluorine in vegetation and biological material.[1, 2]

The concentration of fluoride in samples of urine and blood may vary, depending upon the time of collection of the samples, particularly in relation to the time of the last meal or feeding or to the time of occurrence and the duration of exposure to fluoride in industry.[19, 20] Another consideration is that the quantity of material submitted for analysis must be chosen with regard to the expected concentration of fluoride and the limits of sensitivity of the analytical method to be employed. As an example, the amount of fluoride generally present in the air is so small that, except in unusual situations, it is necessary to sample at least 1.5 cubic meters of air and preferably as much as 5 cubic meters to detect the presence of fluoride at a level of 0.01 part per billion.[21] In air sampling, the method of sampling must also be taken into consideration, since this determines whether gaseous or particulate (liquid or solid) fluorides have been collected. Gaseous fluoride, particularly hydrogen fluoride, will be trapped efficiently by passing air through water or a solution of an alkali in a scrubber or Smith-Greenburg impinger. However, larger particles of solid fluoride will also be trapped, while many of the particles in the submicron range are likely to escape.[30] If a filtration method is used to sample the atmosphere, then not only the aerosols but also hydrogen fluoride which may have been absorbed on or reacted with the aerosol or the filter medium will be collected. Therefore, no single method may be considered applicable to all sampling problems, and the method of air sampling must be selected to fit the problem and the site. It is obvious, therefore, that the reliability of a finding, as well as its significance, depends to a great extent upon the history of the sample, the techniques employed in its collection, and the handling given to it prior to analysis.

Ashing Procedures

The basic procedures in the analysis of the fluoride ion include the fixing of the fluorine in a soluble inorganic form, its separation from extraneous and interfering ions, and its final estimation. Samples such as plant and animal tissues, foodstuffs, and soils must be ashed to remove the organic matter and to concentrate the fluoride. Many of the difficulties ascribed to the analysis of biological material and to the determination of trace amounts of fluoride may be attributed directly to this step.[31] Losses of fluoride will occur if the temperature of ashing is too high, while if the temperature is too low, certain organic and inorganic complex fluoride linkages may fail to release the fluoride. Ashing procedures, in the presence of a variety of fluoride fixatives, as mentioned earlier, at temperatures between 450° and 900° C have been investigated.[1, 3, 17, 18, 22, 31, 42, 48, 52, 53, 72] Contradictions in the various reports indicate that the proficiency of the analyst is a factor, and that, in the case of biological material, specifically, the best results are obtained when the ashing is carried out at 600° C with calcium oxide as the fixative. The latter must be low in fluoride and may require treatment to reduce the fluoride to acceptable levels of 1-3 ppm.[23, 43, 82, 84]

Unreactive combinations of fluoride, which cannot be separated quantitatively, may be produced in the ashing step, or the sample may contain fluoride in a form not easily decomposed by the acids used in the subsequent distillation step. Such interferences occur when the material is rich in silica or when the fluoride is present as aluminum fluoride, fluorite, cryolite, or boron trifluoride. These unreactive combinations may be decomposed by following the ashing step with an alkaline fusion step, such as has been used since the time of Berzelius[10] to decompose refractory material. The latter procedure is now commonly employed in the handling of samples of vegetation.[31, 66, 72] The usual alkaline fusion mixtures, or sodium hydroxide alone, may be used in the ratio of 5 parts of the fusion material to 1 part of ash.[31, 66, 72] Animal tissues (except some samples of lung) are generally so low in silica that their preparation for analysis does not require a fusion step.

The direct ashing of blood with various fixatives at 350° to 750° C has been reported by Smith and Gardner to result in the low recovery of known amounts of fluoride.[79, 80] These investigators, therefore, recommend a direct distillation of fluoride from the blood with sulfuric acid. Losses during ashing were attributed to the formation of a volatile salt of fluorine and iron, but this point has not been demonstrated conclusively. It is possible that losses may occur during the ashing step, when particles of the samples are lost mechanically as spray on

the ignition of combustible gases, and therefore, care must be taken that samples do not flame when placed in an oven. A preliminary heat treatment on an adjustable heater, to volatilize combustible gases with a minimum of turbulence, will reduce the tendency of samples to burst into flame when they are placed in muffle furnaces.

On occasion, it may be necessary to evaporate samples prior to ashing or to concentrate solutions prior to distillation. A number of investigators have reported losses of fluorine during evaporation of slightly alkaline solutions, and various recommendations have been made for carrying out the procedures and for choosing the vessels to be employed.[31] Vessels of nickel, inconel, porcelain, borosilicate glass, and platinum are in current use. In agreement with Elving et al.[31] it is believed that many of the small losses that have been reported are due not to volatilization of fluoride but to mechanical losses or surface interactions, and particularly to adsorption on the surface of the vessel.[31, 81] Vessels that are etched or that are readily etched, therefore, should be avoided when solutions containing trace quantities of fluoride are to be evaporated. Platinum and nickel dishes appear to be the most satisactory.

The Distillation Step

The separation of fluoride from interfering substances by distillation as fluosilicic acid has become standard practice in the analysis of fluorine since the method was first described by Willard and Winter in 1933.[85] Fluorine is separated from interferences as fluosilicic acid by the action of perchloric,[85] sulfuric,[78, 85] or phosphoric acids.[68] The fluosilicic acid is carried out of the distillation flask with water vapor, the boiling point of the solution being held at a constant temperature by the addition of steam or water and by regulating the heat applied to the solution. The addition of steam rather than water reduces the time required for the distillation and eliminates bumping of the solution.[6] Developments in this part of the procedure have dealt mainly with the design of distilling apparatus and with methods for controlling the temperature at which the distillation is carried out. The simplest equipment involves the use of a Claisen flask to reduce spraying or the entrainment of acids.[21, 44] Other developments include the use of a bath of tetrachloroethane to control the temperature of the still,[35] electrical heating devices,[36, 51, 69] electronically controlled apparatus for the steam-distillation of fluosilicic acid at a constant temperature,[87] and devices for making the distilling operation more automatic.[32, 37, 47, 75] The size of the still has also been altered, both to increase the rate of distillation and/or to distill microquantities of fluosilicic acid. Armstrong and Singer use a still of 10 ml. capacity to distill fluoride in the range of 1-5 micrograms,[8] while Samachson and co-workers developed equipment for distilling up to 10 μg of fluoride in 10 ml. of distillate.[73] As pointed out earlier, the distillation of fluosilicic acid may be carried out in the presence of perchloric, sulfuric or phosphoric acids. The choice of acid depends upon the material being analyzed and the nature of the impurities present. Thus in the presence of large quantities of aluminum and silica, the higher temperature obtained with sulfuric acid (up to 165° C) allows for a more complete recovery of fluoride.[52] Better recoveries have also been reported from sulfuric acid than from perchloric, so that in some procedures, double distillations, first from sulfuric acid, followed by concentration of the distillate and then by distillation from perchloric acid at 135° C,[9, 16, 52] are used. However, Committee D-22 on Methods of Atmospheric Sampling and Analysis of the American Society for Testing Materials in its proposed tentative method,[21] states that sulfuric acid cannot be substituted for perchloric acid, since the former may contain more fluoride than is present in the sample. It is also claimed that sulfuric acid in the distillate suppresses the color of the lake, so that 1.5 mg of the acid is the equivalent of 8 μg of fluoride.[21] On the whole, the double distillation procedures improve the recovery of fluoride so slightly that a single distillation from perchloric acid is used commonly in the distillation of fluosilicic acid from such material as food, water, body fluids, animal tissues, and vegetation.

The interferences by borates, aluminum, and silica have been noted by a number of investigators.[21, 24, 26, 66, 72, 85] As noted earlier, these interferences are overcome usually by incorporating an alkaline fusion step[66] into the procedure or by increasing the volume of distillate.[9, 21, 85] Volumes of distillate vary from 100-500 ml., the volume collected depending on the size of sample, the amount of fluorine available, and the nature and quantity of the interfering cations present. When ions which retard the recovery of fluoride are absent, it is possible to recover all of the fluoride in volumes of distillate varying from 50-150 ml.[68, 85] The distillation of fluosilicic acid was found by Dahle and Wichmann[25, 26] to be inversely proportional to the input volume of the flask and directly proportional to the temperature of the solution between 125° and 155° C. In order to fix halide a soluble silver salt is usually added to the distillation flask.[55]

The Determination of Fluoride

Gravimetric, titrimetric, electrometric, polarographic, colorimetric, and spectrographic procedures have been used to determine the fluoride ion in solution.[31] The spectrographic method is the most specific analytical procedure for determining fluoride, but it is not satisfactory for the determination of trace amounts of fluoride, since at least 10 μg of fluoride must be present on the electrode.[15, 64] Colorimetric procedures are best suited for the determination of traces of fluoride in biological and related material. These methods depend upon the change in color that develops as a result of the action of the fluoride ion on colored metal-dye complexes. The changes that occur may be observed visually as in a titrimetric procedure, or they may be measured instrumentally. A great variety of metal-dye complexes have been used, among which are included zirconium-purpurin,[45] zirconium-Eriochromcyanin R,[57] aluminum-hematoxylin,[65] thorium-thoron,[41] aluminum-Eriochromcyanin R,[74] thorium-Chrome Azurol S,[67] and more recently thorium-SPADNS.[40] The latter is an abbreviation for 2-(*p*-sulfonphenylazo)-1,8-dihydroxynaphthalene-3,6-disulfonate. Such ions as aluminum, iron, manganese, phosphate, chloride, oxalate, and sulfate interfere in varying degrees in all of the metal-dye procedures and, in so far as sensitivity and accuracy of analysis are concerned, there appears to be little choice among them. Willard and Horton have studied the various dyes used as indicators for the titration of fluoride with thorium nitrate and conclude that purpurin sulfonate, Alizarin Red S, Eriochromcyanin R, 2,3-dicyanoquinizarin, and Chrome Azurol S are decreasingly effective, in the order given, in direct titration procedures.[86]

The thorium-Alizarin Red S lake has found the greatest favor in the analysis of biological material but must be used under strictly controlled conditions. Interferences must be absent, and, since the hydrogen ion activity is an important factor in the reproducibility obtainable, the determination must be carried out at a controlled pH, although there is some difference of opinion as to the optimum pH value. Titrations have been carried out at pH values varying from 2.7 to 3.5,[1, 5, 28, 45, 46, 85] pH 3 being favored most commonly. The solutions generally are buffered with monochloroacetic acid.[5, 42, 71] All ions which complex with or precipitate thorium, which oxidize the indicator, or precipitate insoluble fluoride salts in weak acid must be absent. The distillation step generally serves to free the fluoride from most interfering ions. Free chlorine, however, may be present in the distillate, as a result of the decomposition of perchloric acid, so that it is necessary to add hydroxylamine hydrochloride,[18] sodium azide,[54] or sodium nitrite[50] to prevent oxidation of the indicator. Chloride salts or hydrochloric acid are not serious interferences, and their presence may actually be beneficial in helping to control the effect of other ions and in maintaining a constant degree of dissociation of the fluoride complex.[79, 88]

Titrations and colorimetry have been carried out in various media. Willard and Winter[85] used alcohol to reduce the dissociation of the fluoride-metal complex, while Armstrong showed that the equivalence of thorium nitrate solutions for fluoride values in the range 0.5-10 μg was more exact in aqueous than in alcoholic media.[7] Most procedures for fluoride in biological material now employ aqueous rather than alcoholic media. The subtle nature of the end-point has led to attempts to employ instrumental titration procedures or direct photometry. Photometric titration procedures have been described by Gwirtsman and associates,[36] by the Aluminum Company of America,[2] and more recently by Dean et al.[29] In the former two procedures, the distillate buffered to pH 3 and containing Alizarin Red S indicator is titrated at 525 μ with a standard solution of thorium nitrate to a selected transmittancy. This procedure is also used in the author's laboratory to titrate quantities of fluoride varying from 1 to 100 μg per 100 ml. of solution in a cell that is 6 inches long.[14] Dean and coworkers[29] have shown that the lack of stoichiometry in the reaction between fluoride and thorium nitrate requires the reading of absorbance at a number of wavelengths in order to obtain reproducible results. They showed that the slopes of the photometric-titration curves for different levels of fluoride varied but without altering the intercept on the volumetric axis. The end-point, therefore, is taken as the intercept of the absorbance curve extrapolated to the volumetric axis.[29] They conclude that an experienced operator can titrate twice as fast visually, but that the instrumental method is a valuable adjunct in laboratories in which fluorine titrations are intermittent, especially when the analyst lacks experience in the visual titration.

Direct photometric procedures have been used to measure the variations in the colors obtained from the reaction of fluoride with peroxidized titanium,[27, 59] iron salicylate,[69] silicomolybdate following the decomposition of fluosilicic acid,[13] zirconium-alizarin sulfonate,[11] thorium-alizarin,[43] thorium-Chrome Azurol S,[67] and zirconium-Eriochromcyanin R,[57] among many other metal-dye complexes.[31] The zirconium-Eriochromcyanin R reagent is less sensitive to interference by sulfate ion and to changes in

pH and is finding increasing favor in fluoride analysis. Armstrong and Singer[8] employ the reagent for estimating fluoride in the range of 1-3 μg. Nielsen[62] develops color in a volume of 5 ml. and claims reproducibility to the extent of ±0.1 μg at the level of 1 μg of fluoride. Melvin et al.[58] develop colors for 1 to 16 μg in a volume of 24 ml. Thatcher[83] has recently reported that the calibration curves derived with the Megregian reagent are sensitive to pH changes and that the pH should be controlled. The reactions between fluoride and the metal complexes are not stoichiometric, and reproducible results are obtained only under strictly controlled conditions and when the concentrations of fluoride are relatively high, approximately in excess of 0.1 μg of fluoride per milliliter of final solution. Neither the photometric titration procedure nor the direct photometric technique offers an important or significant improvement in accuracy over visual titration methods. However, under carefully controlled conditions, these methods increase the speed of analysis and tend to eliminate errors due to such personal factors as sensitivity of color vision or fatigue in association with the titration of a large number of samples.

Recent Developments

The standard methods for determining trace amounts of fluoride fail to satisfy all requirements of reproducibility and sensitivity. The subtle color changes at the point of equivalence, the dilution of fluoride in large volumes of distillate, the use of aliquots of the distillate, plus the extraneous fluoride due to reagents (generally in the range of 1-3 μg of fluorine) make it difficult to determine with accuracy quantities smaller than 5 μg of fluoride. There is, therefore, considerable activity in the development of improved methods for the determination of trace concentrations of fluorine. Efforts have been directed toward concentrating fluorine and separating it from interfering ions by steps other than distillation. The elimination of the ashing step would also speed up the analysis of certain materials (particularly blood, water, and biological liquids) and eliminate a step responsible for some of the analytical difficulties that are encountered. Investigations involving ion exchange material show definite promise, and considerable progress has been made in the application of these materials.[3, 14, 58, 62, 63] Ashing and distillation have been shown by Nielsen and Dangerfield,[63] to be unnecessary in the analysis of air samples when the fluorine in a weak acid solution is adsorbed on Duolite A41. The same ion exchange material has been adapted by Melvin et al. to the determination of fluoride in blood.[14, 58] In this procedure, 1 to 60 μg of fluoride, added to 5 ml. samples of blood, have been recovered with an average accuracy of better than 85%. Fluorine from deproteinized samples of laked blood, freed from phosphate and sulfate, is adsorbed on a small column of Duolite A41. The fluoride is then eluted from the column with 5 ml. of 0.1 N sodium hydroxide, hydrochloric acid, or sodium acetate, and is determined by the standard titration procedure or by direct photometry with the Megregian reagent.[57] Dowex 1 or 2 has been employed by Nielsen to concentrate fluoride from distillates.[61] This investigator has also successfully employed weakly acid solutions of ashed material, thereby eliminating the distillation step. Ion exchange columns can also be used to separate fluoride from interfering cations and anions,[61, 89] and this application has promise in the investigation of air pollution. The combination of cation and anion exchange columns has also been used to eliminate the distillation step,[61] and other approaches to eliminate this step have also been reported. Paper chromatography has recently been applied to separate fluorine from soluble interfering ions, with recoveries that averaged 89% in the range of 1-20 μg of fluorine.[38]

Another very sensitive method for determining fluoride in solution makes use of the inhibition of enzymatic activity. This method was first proposed as a qualitative test by Amberg and Loevenhart,[4] and was described as a quantitative method by Scott[76] in 1925. More recently, Linde[49] described a method by which the fluoride in whole blood was determined by the inhibition of the hydrolysis of ethyl butyrate by hog-liver esterase. He claimed an ability to detect as little fluoride as 0.1 ppm, and found the method particularly suited for the differentiation between soluble and insoluble fluoride.

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Bibliography

1. Aluminum Company of America: Determination of Fluorine, Method 1330 (6-53).

2. Aluminum Company of America: Photometric Titration of Fluoride with 0.01 N Thorium Nitrate, Method 914D-May, 1956.

3. Aluminum Laboratories, Ltd.: Determination of Total Fluorine in Fluorspar, Acidimetric Procedure Following Ion Exchange, Standard Methods, 497-55 and 498-55, 1955.

4. Amberg, S., and Loevenhart, A. S.: Further Observations on the Inhibiting Effect of Fluorides on the Action of Lipase, Together with a Method for the Detection of Fluoride in Food Products, *J. Biol. Chem.* 4:149, 1908.

5. Armstrong, W. D.: Colorimetric Determination of Fluorine, *Indust. & Engin. Chem., Anal. Ed.* 5:300, 1933.

6. Armstrong, W. D.: Microdetermination of Fluorine: Elimination of Effect of Chloride, *Indust. & Engin. Chem., Anal. Ed.* 8:384, 1936.

7. Armstrong, W. D., and Singer, L.: Microdetermination of Fluoride in Biological Materials and the Biochemical Role of Fluoride. Progress Report. Contract ⇵DA-49-007-MD-390, 0.1. ⇵91-53. Office of the Surgeon General, Dept. of the Army 7/16/54 to 6/20/55.

8. Armstrong, W. D. and Singer, L.: Progress Report, Contract ⇵DA-49-007-MD-390, 0.1. ⇵91-53. 6/21/56 to 6/15/57.

9. Association of Official Agricultural Chemists: Official Methods of Analysis of the Association of Official Agricultural Chemists, Ed. 4, Washington, D.C. 1955.

10. Berzelius J.: (Analysis of Gadolinite), *Ann. chim. et phys.* 3:26, 1816.

11. Bumsted, H. E., and Wells, J. C.: Spectrophotometric Method for Determination of the Fluoride Ion, *Anal. Chem.* 24:1595, 1952.

12. Busch, G. W.; Carter, R. C., and McKenna, F. E.: Fluorine and Fluorocarbons, in Rodden, C. J., Editor: Analytical Chemistry of the Manhattan Project, New York, McGraw-Hill Book Co. Inc., 1950, p. 226.

13. Cade, G. N.: Photometric Determination of Fluosilicic Acid in Hydrofluoric Acid, *Indust. & Engin. Chem., Anal. Ed.* 17:372, 1945.

14. Cholak, J.: Analytical Procedures—Reliability, Usefulness. Ease of Determination, Symposium on Fluoride, Dec. 9-11, 1957, Kettering Laboratory, Department of Preventive Medicine and Industrial Health, University of Cincinnati.

15. Churchill, H. V.: Occurrence of Fluorides in Some Waters of the United States, *Indust. & Engin. Chem.* 23:996, 1931.

16. Churchill, H. V.; Bridges, R. W., and Rowley, R. J.: Interference of Phosphorus in the Determination of Fluorine, *Indust. & Engin. Chem., Anal. Ed.* 9:222, 1937.

17. Churchill, H. V.; Rowley, R. J., and Martin, L. N.: Fluorine Content of Certain Vegetation in a Western Pennsylvania Area, *Anal. Chem.* 20:69, 1948.

18. Clifford, P. A.: Report on Fluorine, *J. A. Offic. Agricultural Chemists* 24:350, 1941.

19. Collings, G. H., Jr.; Fleming, R. B. L., and May, R.: Absorption and Excretion of Inhaled Fluorides, *A.M.A. Arch. Indust. Hyg.* 4:585, 1951.

20. Collings, G. H., Jr.; Fleming, R. B. L.; May, R., and Bianconi, W. O.: Absorption and Excretion of Inhaled Fluorides; Further Observations, *A.M.A. Arch. Indust. Hyg.* 6:368, 1952.

21. Committee D-22: Proposed Method for the Determination of Inorganic Fluoride, American Society for Testing Materials, 1957.

22. Crutchfield, W. E. Jr.: Magnesium Acetate as an Ashing Agent in Fluorine Analysis, *Indust. & Engin. Chem., Anal. Ed.* 14:57, 1942.

23. Dahle, D.: Report on [the Determination of] Fluorine in Foods, *J. A. Offic. Agricultural Chemists* 18:194, 1935.

24. Dahle, D., and Wichmann, H. J.: The Determination of Fluorine in the Presence of a Large Excess of Aluminum Ions, *J. A. Offic. Agricultural Chemists* 19: 320, 1936.

25. Dahle, D., and Wichmann, H. J.: A Quantitative Study of Fluorine Distillation, *J. A. Offic. Agricultural Chemists* 19:313, 1936.

26. Dahle, D., and Wichmann, H. J.: Further Studies of Fluorine Distillation, *J. A. Offic. Agricultural Chemists* 20:297, 1937.

27. Dahle, D.: A New Procedure for Determination of Fluorine by the Peroxidized Titanium Method, *J. A. Offic. Agricultural Chemists* 20:505, 1937.

28. Dahle, D.; Bonnar, R. U., and Wichmann, H. J.: Titration of Small Quantities of Fluorides with Thorium Nitrate: I. Effect of Changes in the Amount of Indicator and Acidity, *J. A. Offic. Agricultural Chemists* 21:459, 1938.

29. Dean, J. A.; Buehler, M. H., and Hardin, L. J.: Comparison of Spectrophotometric and Visual Titration for the Determination of Fluorine, *J. A. Offic. Agricultural Chemists* 40:949, 1957.

30. Drinker, P., and Hatch, T.: Industrial Dust, Ed. 2, New York, McGraw-Hill Book Co., 1954.

31. Elving, P. J.; Horton, C. A., and Willard, H. H.: Analytical Chemistry of Fluorine and Fluorine-Containing Compounds, in Simons, J. H., Editor: Fluorine Chemistry, New York, Academic Press Inc.. 1954, p. 51.

32. Estill, W. B., and Mosier, L. C.: Automatic Apparatus for Fluoride Distillation, *Anal. Chem.* 27: 1669, 1955.

33. Flagg, J. F.: Analytical Methods, in Voegtlin, C. and Hodge, H. C., Editors: Pharmacology and Toxicology of Uranium Compounds, New York, McGraw-Hill Book Co., Inc., 1949, Vol. 1, Chap. 2, p. 147.

34. Fryd, C. F. M.: Trace Elements in Food—2. Fluorine, *Food Manufacture* 31:236, 1956.

35. Gilkey, W. K.; Rohs, H. L., and Hansen, H. V.: Improved Apparatus for Isolation of Fluorine—Willard and Winter Method, *Indust. & Engin. Chem., Anal. Ed.* 8:150, 1936.

36. Gwirtsman, J.; Mavrodineanu, R., and Coe, R. R.: Determination of Fluorides in Plant Tissue, Air and Water: Apparatus and Procedures, *Anal. Chem.* 29:887, 1957.

37. Huckabay, W. B.; Welch, E. T., and Metler, A. V.: Constant-Temperature Steam-Distillation Apparatus for Isolation of Fluorine, *Anal. Chem.* 19:154, 1947.

38. Hall, R. J.: The Use of Paper Chromatography for the Detection and Determination of Microgram Amounts of Inorganic Fluoride, *Analyst* 82:663, 1957.

39. Hernler, F., and Pfeningberger, R.: Mikro-Halogenbestimmungen: Fluor und Chlor, *Mikrochemie* 25: 267, 1938.

40. Hollingworth, R. P.: Spectrophotometric Determination of Fluorine in Rocks, *Anal. Chem.* 29:1130, 1957.

41. Horton, A. D.; Thomason, P. F., and Miller, F. J.: Spectrophotometric Determination of Inorganic Fluoride, *Anal. Chem.* 24:548, 1952.

42. Hoskins, W. M., and Ferris, C. A.: A Method of Analysis for Fluoride: Application to Determination of Spray Residue on Food Products, *Indust. & Engin. Chem., Anal. Ed.* 8:6, 1936.

43. Icken, J. M., and Blank, B. M.: Determination of Fluorides: Spectrophotometric Adaptation of Method of Association of Official Agricultural Chemists, *Anal. Chem.* 25:1741, 1953.

44. Klement, R.: Der Fluorgehalt der Knochen und Zähne, Ber. deutsch. chem. Ges. 68B, 2012, 1935.

45. Kolthoff, I. M., and Stansby, M. E.: Detection and Estimation of Small Amounts of Fluorine: Application of the Zirconium Purpurin Test, *Indust. & Engin. Chem., Anal. Ed.* 6:118, 1934.

46. Kortüm-Seiler, M.: Eine Photometrische Fluor-Bestimmung mit Eisensalicylat, *Angewandte Chem. A* 59:159, 1947.

47. Kuyper, A. C.: Automatic Control for Fluoride Distillation, *Anal. Chem.* 28:922, 1956.

48. Largent, E. J.: Aliquant Samples in the Deter-

mination of Fluorides in Mixed Foods, *Indust. & Engin. Chem., Anal. Ed.* 13:93, 1941.

49. Linde, H. W.: Estimation of Small Amounts of Fluoride Ion by Enzyme Inhibition, Air Reduction Co., Analytical Method No. 112, 1956.

50. Lockwood, H. C.: Fluorine in Food Products, *Analyst* 62:775, 1937.

51. Ma, T. S., and Gwirtsman, J.: Microdetermination of Fluorine in Organic Compounds, *Anal. Chem.* 29:140, 1957.

52. MacIntire, W. H., and Hardin, L. J.: Absence of Reversion in Ammoniated and Limed Superphosphate of Low Fluorine Content, *J. A. Offic. Agricultural Chemists* 23:388, 1940.

53. MacIntire, W. H., and Hammond, J. W.: Use of Peroxides of Calcium and Magnesium in Determination of Fluorine Content of Soils, Siliceous Materials and Organics, *J. A. Offic. Agricultural Chemists* 22:231, 1939.

54. McClendon, J. F., and Foster, W. C.: Determination of Dietary Fluorine, *Indust. & Engin. Chem., Anal. Ed.* 13:280, 1941.

55. McClure, F. J.: Microdetermination of Fluorine by Thorium Nitrate Titration, *Indust. & Engin. Chem., Anal. Ed.* 11:171, 1939.

56. McKenna, F. E.: Methods for Fluorine and Fluoride Analysis, I, II, III, *Nucleonics* 8, No. 6:24; 9, No. 1: 40; No. 2:51, 1951.

57. Megregian, S.: Rapid Spectrophotometric Determination of Fluoride with Zirconium-Eriochrome Cyanine R Lake, *Anal. Chem.* 26:1161, 1954.

58. Melvin, W.; Yeager, D., and Cholak, J.: Application of Ion Exchange Resin to the Determination of Fluoride in Blood, Paper presented at the 19th meeting of the American Industrial Hygiene Association, Atlantic City. April 24, 1958. (See also Reference 14.)

59. Van der Merwe, P. K.: The Microdetermination of Fluorine, *Onderstepoort J. Vet. Sc. & Animal Indust.* 14:359, 1940.

60. Merwin, H. E.: Coloration in Peroxidized Titanium Solutions, with Special Reference to the Colorimetric Methods of Estimating Titanium and Fluorine, *Am. J. Sc.* 28:119, 1909.

61. Nichol, A. A.; Benedict, H. M.; Byrne, J. L., and McCarty, C. P.: The Determination of the Fluoride Content of Natural Vegetation, *J. Air Pollution Control A.* 6:239, 1957.

62. Nielsen, H. M.: Determination of Microgram Quantities of Fluoride, *Anal. Chem.* 30:1009, 1958.

63. Nielsen, J. P., and Dangerfield, A. D.: Use of Ion Exchange Resins for Determination of Atmospheric Fluorides, *A.M.A. Arch. Indust. Health* 11:61, 1955.

64. Papish, J.; Hoag, L. E., and Snee, W. E.: Spectroscopic Detection of Fluorine, *Indust. & Engin. Chem., Anal. Ed.* 2:263, 1930.

65. Price, M. J., and Walker, O. J.: Determination of Fluoride in Water by the Aluminum-Hematoxylin Method, *Anal. Chem.* 24:1593, 1952.

66. Remmert, L. F.; Parks, T. D.; Lawrence, A. M., and McBurney, E. H.: Determination of Fluorine in Plant Materials, *Anal. Chem.* 25:450, 1953.

67. Revinson, D., and Harley, J. H.: Spectrophotometric Determination of Fluoride Ion with Chrome Azurol S, *Anal. Chem.* 25:794, 1953.

68. Reynolds, D. S.: Further Studies on the Willard and Winter Method for the Determination of Fluorine, *J. A. Offic. Agricultural Chemists* 18:108, 1935.

69. Reynolds, D. S.; Kershaw, J. B., and Jacob, K. D.: A Multiple-Unit Distilling Apparatus for Determination of Fluorine by the Willard and Winter Method, *J. A. Offic. Agricultural Chem.* 19:156, 1936.

70. Rinck, E.: Séparation et dosage du fluor, *Bull. Soc. chim. France* 1948:305.

71. Rowley, R. J., and Churchill, H. V.: Titration of Fluorine in Aqueous Solutions, *Indust. & Engin. Chem., Anal. Ed.* 9:551, 1937.

72. Rowley, R. J.; Grier, J. G., and Parsons, R. L.: Determination of Fluoride in Vegetation, *Anal. Chem.* 25:1061, 1953.

73. Samachson, J.; Slovik, N., and Sobel, A. E.: Microdetermination of Fluorine, *Anal. Chem.* 29:1888, 1957.

74. Saylor, J. H., and Larkin. M. E.: Titration of Fluoride Ion with Aluminum Chloride, *Anal. Chem.* 20:194, 1948.

75. Schall, E. D., and Williamson, H. G.: A Simple Apparatus for Automatically Controlling the Distillation of Fluorine as Hydrofluosilicic Acid, *J. A. Offic. Agricultural Chemists* 38:452, 1955.

76. Scott, W. O.: U. S. Chemical Corp. Report EAMRD-33, 1925. Cited by Elving et al.[77]

77. Scott's Standard Methods of Chemical Analysis, Ed. by N. H. Furman, Ed. 5, New York, D. Van Nostrand Co., 1939, Vol. 1, p. 399.

78. Shuey, G. A.: Report on the Determination of Fluorine Compounds (in Insecticides, etc.), *J. A. Offic. Agricultural Chemists* 18:156, 1935.

79. Smith, F. A., and Gardner, D. E.: Investigations on the Metabolism of Fluoride: 1. The Determination of Fluoride in Blood, *J. Dent. Res.* 30:182, 1951.

80. Smith, F. A., and Gardner, D. E.: Fluoride Studies, in Voegtlin, C. and Hodge, H. C., Editors: Pharmacology and Toxicology of Uranium Compounds, New York, McGraw-Hill Book Co., Inc., 1953, Vol. 1, p. 1167.

81. Specht, R. C.: Interaction of Fluoride Ions and Ground Glass, *Anal. Chem.* 28:1015, 1956.

82. Stanford Research Institute: Preparation of Various Materials for Fluorine Analysis, A.S.M. 14.05, April 18, 1956. Preparation of Samples for Fluoride Analysis, A.S.M. 14.06 April 18, 1956.

83. Thatcher, L. T.: Modified Zr-Eriochrome Cyanine R Determination of Fluoride, *Anal. Chem.* 29: 1709, 1957.

84. Weddle, D. A., and Maurer, R. L.: Method for Preparation of Fluorine-Low Calcium Oxide, *Anal. Chem.* 26:584, 1954.

85. Willard, H. H., and Winter, O. B.: Volumetric Method for the Determination of Fluoride, *Indust. & Engin. Chem., Anal. Ed.* 5:7, 1933.

86. Willard, H. H., and Horton, C. A.: Indicators for Titration of Fluoride with Thorium, *Anal. Chem.* 22: 1190, 1950.

87. Willard, H. H.; Toribara, T. Y., and Holland, L. N.: Electronically Controlled Apparatus for Distillation of Fluorine as Hydrofluosilicic Acid, *Anal. Chem.* 19:343, 1947.

88. Williams, H. A.: The Titration of Microgram Quantities of Fluorides, *Analyst* 71:175, 1946.

89. Zipkin, I; Armstrong, W. D., and Singer, L.: Chromatographic Separation of Fluoride and Phosphate, Letter to the Editor, *Anal. Chem.* 29:310, 1957.

Industrial Medical Association

THE PRESIDENT'S MESSAGE

D. JOHN LAUER, M.D.

RECENTLY, President Elmer Wheeler of the American Industrial Hygiene Association informed us that his organization will not participate in the annual Industrial Health Conference after the meeting in Rochester in April, 1960. This action was not unexpected. We wish them well in their new venture. Our joint, perennial gatherings have been pleasant and fruitful.

The AIHA has been growing steadily and lustily since its nativity 20 years ago. The timing of this birth was fortunate for the nation as well as the professional field. World War II, which started soon thereafter, saw a burgeoning of the industrial hygiene services. The new Association provided a professional structure and a home for the hundreds of persons who shortly became engaged in the field.

From the multi-disciplinary backgrounds of the new participants came a wealth of original investigation that provided program materials for concurrent section meetings. The aggregate was a full treatment of the contributions of the physical sciences to the occupational health field. This made for unusually fruitful annual conferences with the other participating groups whose work is more intimately based in the social and clinical sciences.

The Industrial Health Conference has grown so much in recent years that many of its attendants have found it difficult to be present at sessions in which they have particular interests. With the AIHA meeting to be held at a different time this problem will be substantially reduced. Those of us whose interests span both conferences can and will attend both.

It might be well at this point to sketch out just how the business aspects of the Industrial Health Conference operate. The broad administrative policies of the conference are annually determined by representatives of the participating organizations. The implementing details are supplied by the salaried staff of the IMA. The conference income is from two sources: registration fees and space rentals from commercial exhibits. The charges against these incomes are: administration, usually about 25% of the exhibit income; commissions for commercial exhibit space sales—25% of such sales; and variable charges for such items as printed programs and meeting room services and equipment.

Prior to this year the money which was left over was split—across the board—in proportion to the number of conference registrants from each organization. In the 1959 split recognition was given to the fact that the participating groups make different demands with respect to meeting room needs. Costs were accordingly charged. A professional audit of these accounts is made each year, and each organization is provided with a certified copy of the audit.

A smaller attendance will necessitate a more modest set of arrangements. This too may be salutary. Changes in the conference format are in the making. In all successful ventures changes are needed periodically, so that success may continue.

Editorials

Employment of the Handicapped

A study recently concluded in New York City is the basis of a report* on a vital aspect of the general problem of employment of handicapped applicants for work: the policies, practices, and attitudes of the personnel officers or other executives responsible for hiring. The research team derived its data from direct interviews with the personnel officers of smaller firms (a few with less than 200 employees, 174 firms with 200 to 499 employees, and 199 firms with 500 or more employees) randomly selected from seven designated industries† employing a total of 2,000,000 persons—about 43% of the work force in New York City—and representing the majority of job opportunities in the area suitable for the partially disabled worker.

The prejudice against the hiring of the partially disabled was confirmed. Only 37% of the firms with 500 or more employees had hired one or more handicapped persons. Among firms with 200 to 499 employees this figure dropped to 22%.

Perhaps the major finding of this study was the fact that formal written policies and practices regarding the hiring of handicapped workers were practically nonexistent. In most of the firms, the "operating" policies that guide their day-to-day employment practices were not based upon deliberate management decisions but reflected the combination of individual views and personal prejudices that constituted the prevailing "company climate" toward the physically handicapped.

The decentralization of hiring in most of the firms—after an initial screening by a personnel officer, there was a diffusion of this responsibility among department heads, supervisors, section chiefs, foremen, and related workers—gave a host of individuals authority to reject applicants for employment. In view of the lack of a definitive policy, this meant that, while any one of that group might veto the hiring of a handicapped worker, unanimous approval was required for his acceptance.

In previous surveys of employment practices, the most influential reasons for excluding handicapped applicants were found to be the management's fear of liability for excessive workman's compensation costs and their concern about an inordinate drain on company-sponsored life, disability, and medical care insurance programs. Surprisingly, the present investigators found that these cost factors played only a very minor role in determining the hiring policy. A discomforting finding was the lack of familiarity with the New York Second Injury law, which, in workmen's compensation terms, tends to make the physically handicapped employee a preferred risk. Only a few of those who claimed to be familiar with this law reported that it had influenced them to look more favorably upon the hiring of the handicapped. Further, the other reasons commonly advanced against the hiring of handicapped workers—physical limitations, lack of versatility, low productivity, excessive absenteeism, accident-proneness, and the like—did not seem to have any great influence. Neither did any of the

*Federation Employment and Guidance Service: Survey of Employers' Practices and Policies in the Hiring of Physically Impaired Workers, New York, N. Y., May, 1959. Copies may be obtained by sending 25 cents to cover mailing costs to Mr. Roland Baxt, Executive Director, 42 E. 41st St., New York 17, N. Y.

†The seven industries were apparel, printing and publishing, wholesale trade, retail trade, finance and insurance, hotel and amusement, and light manufacturing. The study was not limited to cardiacs; it also investigated workers handicapped by orthopedic defects, epilepsy, cerebral palsy, and defective vision.

reasons frequently advanced *for* hiring the handicapped, such as their increased loyalty and conscientiousness, better attendance, and motivation to "prove" themselves, seem consistently to influence the personnel officers who did employ them.

The one factor found by the investigators to exert a significant influence on hiring practices was a favorable previous personnel experience with employed workers with a similar handicap. This is substantiated by the experiences of such organizations as Abilities, Inc., of New York, and the Epi-Hab Shops, in Sawtelle, Calif., and their prototypes. The living demonstration that a medical disability is not necessarily a handicap in industry probably represents, therefore, at least for the present, the most persuasive argument for restoring partially handicapped workers to the status of independent "first-class" citizens.

The maintenance of a medical department or the requirement of a preplacement medical examination, usually encountered only in the larger firms, was found to have no effect on the hiring of handicapped workers. This appeared to be a reflection of the ignominious role played by the physician who performed these duties. Trenchantly depicted as a "highly specialized technician" without any influence on employment policies or practices, he was found merely to screen applicants, noting the medical findings for evaluation by the personnel officer who made the final decision regarding their significance. True selective placement was practiced only in a few of the firms with medical programs. In fact, most of the physicians had only a general knowledge of the specific requirements of the jobs for which they conducted examinations. While these findings are not new, they are, nonetheless, disquieting to those engaged in elevating the standards of industrial medical practice in "small" plants. They provide ample support for the contention that the future growth of occupational medicine does not depend on creating new medical units or procuring jobs in industry for physicians. It does depend on the establishment of a good medical program, the indoctrination of management to give that program proper scope and authority, and the education of the physician so that he can conduct it effectively.

—Guest editorial by LEON J. WARSHAW, M.D.

Year End

The end of 1959 is not the best point at which to form a judgment upon the first year of life of our new journal. The beginning can not stand alone. The achievement of the first year inevitably will be measured in terms of the stature gained in the years ahead. Let this judgment, then, fall to other persons and other times. Here and now let us consider things which are best understood while they are fresh.

The objectives we set for JOURNAL OF OCCUPATIONAL MEDICINE at the outset have been realized in part. We want to provide the industrial physician in a single journal with the material he must have for a full understanding of modern industrial practice; and we want to present this information authoritatively, in a context that is interesting and a style that is readable. To achieve this level of publication quickly we issued invitations to colleagues to prepare special articles, as a result of which much of our first volume has been tailormade. The demonstration of what was wanted apparently stimulated the writing of a wealth of good material that was lying dormant. Our problem now is to find the space for articles that ought to appear in print at the earliest possible time.

A typical issue of our journal results from the coordinated efforts of 30 to 50 persons: the named authors of articles and reviews, the members of the editorial board, abstracters, various consultants, and staff. The year ends in a climate of achievement shared with this great number of old and new friends. To these, and to the readers of our journal around the world, we extend wishes for a Merry Christmas and a Happy New Year.

Book Reviews

BASIC ISSUES IN PSYCHIATRY. Paul V. Lemkau, M.D. Price, $3.50. Charles C Thomas, Publisher, 301-327 E. Lawrence Ave., Springfield, Ill., 1958.

Dr. Paul Lemkau is Professor of Public Health Administration, School of Hygiene and Public Health of The Johns Hopkins University, and he is also the author of "Mental Hygiene in Public Health" which was revised in 1955.

The present work is based upon five lectures delivered in the postgraduate medical education program of the University of Florida. The material has a practical bearing upon problems encountered by general physicians and by occupational physicians. The author's method of presentation is clear and concise and the style, understandably, is colloquial.

Chapter 1, "The Size and Range of Mental Health Problems," contains interesting data; for example, most areas in the United States require one hospital bed for psychiatric treatment for each 200 of the population and for New York State "of every twelve children born, one will spend some time in a mental hospital." There is an accumulation of uncured psychiatric patients; "The surgeon buries his failures, whereas the psychiatrist has to see his every day in the psychiatric hospital." Commenting on two recent social psychiatric studies—"both studies come up with 14 per cent of people who are free of psychiatric symptomatology, and 14 per cent of the population completely well. Both studies agree that some place between 30 and 50 per cent of the population has sufficient symptomatology so that if they came to a psychiatrist he would be inclined to try to treat them."

Chapter 2, "The Preservation of Central Nervous System Tissue," begins with the concept of prevention. There are three steps in prevention: primary prevention, preventing disease itself; second, the quick treatment of the disease; and, finally, the treatment of the complications of the disease. The causation of psychiatric illness is divided into two categories, brain damage and malfunction of an intact brain. Concerning behavior changes due to brain damage, there are involved the personality itself and the attitudes and patterns of previous behavior. For example, the brain damage due to alcoholism is dependent upon the person's excess drinking. Infections, toxins, and malnutrition are also discussed briefly.

Chapter 3, "The Prevention of Psychogenic Illness," will well repay reading. There is an account of alterations in behavior produced by varying degrees of isolation of the human being in infancy and in the adult. The reaction to conflict and to stress is examined. If there is some degree of anticipation of a stressful situation, stress can be minimized. This can be applied to induction into the military service, childbirth, onset of menstruation, marriage.

Chapter 4, "Treatment in Psychiatry," gives a good account of the basic principles of psychotherapy. Electric shock treatment, insulin therapy, and the newer drug therapies are also described.

The final chapter "Administration of Psychiatric Programs," ranges over many aspects of the subject. There is now a tendency to turn away from the large mental hospitals, and to develop the "urbanization" of the mental hospital and "to bring the psychiatrist and his patients into a closer organizational pattern with medical education and medical practice." Finally, the author makes a plea for psychiatrists to get out of their offices: "I think psychiatry, as it becomes reintegrated into medicine more thoroughly, will find itself with duties to patients who must be seen where they are sick, as well as where they can come, for acute treatment."

—GRAHAM C. TAYLOR, M.D.

A HISTORY OF INDUSTRIAL CHEMISTRY. F. Sherwood Taylor, Ph.D. Price, $7.50. Pp. 467, with 22 plates and 62 drawings. Abelard-Schuman Limited, Publishers, 404 Fourth Ave., New York 16, N. Y., 1957.

This interesting and detailed chronicle is the late Dr. Taylor's final contribution to the chemical literature of England and the world. The author has presented histories of theoretical chemistry and other allied sciences in previous manuscripts. This one he limits to the field of industrial chemistry, and herein lies its interest for the practitioner of occupational medicine. Its appeal will be greatest, of course, to those allied with the chemical manufacturers, but the scope of the book is large enough to engage the attention of anyone with a scholarly bent or even a slight inclination in this direction.

The author's intent was to present a short history of industrial chemistry, "from the earliest times down to the present day." He states at the outset that his interest lies chiefly with the principles, rather than with the men involved in their delineation. He has, therefore, built his book with little of people and much of chemistry. Its 467 pages, 22 plates, and 62 drawings attest to the detail and completeness which the author has striven for.

To a physician who recalls with a twinge of disquiet his student days with biochemistry and its formidable relatives, the book may seem to be one of doubtful interest and questionable compensation. For those of the "pure-science-and-to-hell-with-art" mold this conclusion may well be a valid one. It is doubtful that this volume will be of any practical aid in one's daily labors. But for those with even a mild interest in the panorama of historical events which has brought the chemical science to its present evolutionary status, the book will hold a rich reward.

Dr. Taylor divides his history into two arbitrary periods. In the "Prescientific Chemical Industry" he records man's snail-like progress from the neolithic fire-makers and pottery artisans into the lightening dawn of civilization. He notes that while

some of the primitive arts graduated early to the status of sciences (e.g., medicine) it was the fate of chemistry to remain relegated to the lower status of an empirical craft throughout the 5,000 years between the Kingdom of Egypt and the 18th century. During this period one finds the perpetuation of an unsystematized type of artisanry which, nevertheless, somehow crawled over seemingly insuperable barriers to develop production of the earliest metals, cements, ceramics, glass, pigments, fuels, and dyes . . . all of these without any knowledge of the underlying chemical reactions which made them possible.

The second, or scientific, period began in the mid-18th century and developed with phenomenal rapidity into the benevolent hydra that is today's chemical industry. Compared with its previous slow growth the science fairly rockets through one revolutionary discovery after another. The atomic theory is advanced, the elements are discovered and isolated one by one, the periodic table is developed, the theory of valence, bonds, and structural formulae arises, the idea of organic synthesis is born . . . and from these and a hundred other "breakthroughs" there springs a "new" industry which today shapes and affects our lives on almost every hand. Whole chapters in this new era are devoted to nuclear chemistry, electrochemistry, and industrial gas reactions. The author traces in detail the steps which opened the door to the mass production of gases, synthetic drugs, plastics, dyes, textiles, explosives, detergents, petrochemicals, and a host of other consumer products.

But while he chronicles the fantastic achievements of recent times, the author chides us to recall with equal respect the long-gone past. As he puts it, "The past gave birth to the present and we can understand ourselves and our age only in the light of the past whose ideas we inherit and whose air we still breathe." He concludes with these words, "There is no end to history save at the frontier of the present. No one can predict the rate of our advance toward the solution of man's impotence and want; who lives shall see."

Dr. Taylor died shortly after completing this work. With him, the world lost a scholarly historian, scientist, philosopher, and author . . . all at once.

—R. E. JOYNER, M.D.

PRINCIPLES OF ADMINISTRATION APPLIED TO NURSING SERVICES. H. A. Goddard. Price, $4.00. Pp. 106. Mongraph Series No. 41. World Health Organization, Geneva, Switzerland, 1958. Available from Columbia University Press, International Document Service, 2960 Broadway, New York 27.

This book is the result of the thinking together of an expert committee (nurses from many countries) whose term of reference was nursing service administration. This small book has four major chapters. In these, the Principles, The Application of Principles, The Techniques, and a Philosophy of Administration are clearly stated with exceptionally graphic illustrations. Hospital and public health nursing situations are used. This limits the value of the book for occupational health nurses only slightly. The who, what, why of nursing administration is the focus, and these are basic and applicable in all situations. Nurses who are responsible for the wise utilization of nursing resources and for the management of a nursing service will find this a most valuable addition to their library. The six-part appendix—two sample nursing plans, sample job description, qualification and specification forms, sample graphic assessment scales, and an annotated bibliography—enhance the usefulness of this publication.

It has been stated that "lack of administration skill can only be cured by persuading administrators to become more skillful." This book makes possible the first essential, that of better understanding of the principles upon which administration is based. It clearly differentiates supervision and administration and illustrates the importance of meaningful communication between members of a staff.

This book is recommended enthusiastically to all who have responsibility for policy making and for coordination of the efforts of persons who provide nursing service to individuals. The novice as well as the more experienced nursing administrator will find in this book the basic principles of nursing administration and sufficient information about techniques to make these meaningful.

—MARY LOUISE BROWN, R.N., M. LITT.

Letters

TO THE EDITOR: You may be interested in a follow-up to my letter which you were kind enough to publish in the May 1959 issue of the Journal. In it I called attention to the desirability of having IMA members donate subscriptions to the Journal to hospital medical school libraries where it may attract the attention of medical students, interns, residents, and physicians engaged in private practice. In these locations the Journal would offer "an excellent medium to convey to students and young physicians the philosophy and the concepts of occupational medicine for which the IMA stands, as well as some of the information its practice requires."

The subscription sent to the Medical Library of the Beth Israel Hospital in New York City appears to be accomplishing this purpose. Mrs. Flora Ortman, the Medical Librarian, informs me that each issue of the Journal receives a fair amount of attention from those browsing in the Current Periodicals section of the Library and, in addition, appears to have won a number of regular readers. I have been delighted on a number of occasions by comments from colleagues previously virtually unacquainted with occupational medicine, that obviously stemmed from material published in the Journal.

LEON J. WARSHAW, M.D., Medical Director
Paramount Pictures Corporation
New York 36, N.Y.

For convenience in ordering gift subscriptions, we have provided a clip-out form on page 33a of this issue.—Editor

Abstracts of Current Literature

Mental Health

Graham C. Taylor, M.D.

Mental Illness, Reversible and Irreversible. F. G. Ebaugh.* J.A.M.A. 171:377 (Sept. 26) 1959. (*1801 High Street, Denver)

There is a gradual change taking place in the pattern of the care of the mentally ill, and this article, by a well-known psychiatrist and psychiatric educator, highlights some of the changes which are occurring.

"In the midst of the enlightened clamor in the lay press today about the staggering human and monetary cost of mental illness in the United States, I become increasingly concerned about what I choose to term the 'dead zone' in the mental illness program—the vast area of untapped resources where, as in the eye of the hurricane, the sound does not penetrate and the spark of action remains unstruck." A patient may be surrounded by resources, but yet these resources are not mobilized so as to provide a consistent continuous pattern of care. In the past, there were nonintegrated community resources which might refer the patient to outpatient clinics but there was more or less a general irreversible trend toward long-term stay in hospitals—often a custodial care. There are zones of defense, the first being the community zone, which has been the most neglected for a number of years, the second being the outpatient or open hospital, and the third being the long-term hospitalization. Ebaugh states that "reversibility is movement away from the hospital, treatment of personality disorders in the midst of the dynamic forces which produce them, at a community level. In this context, the family doctor becomes the central focus." This viewpoint is in accord with recent devolopments.

Note: In the opinion of the abstracter, it is not necessary to assume that the flow to the mental hospital—namely zone three—implies an irreversible process inasmuch as the trend is toward a reduction in the duration of stay of patients.

The author also argues, soundly, for the building of small mental hospitals which should be close to university medical centers and close to the community. He points out the need for an increased number of mental hygiene clinics and for better facilities for the treatment of emergency psychiatric problems. Another healthful sign is the development of psychiatric wards in general hospitals. As the author says, "the direction in which the solutions lie is clear, and the diagrams are very nearly complete."

Medical, Social, and Legal Aspects of Suicide. R. D. Dripps,* M. E. Linden, and H. H. Morris, J.A.M.A. 171:523 (Oct. 3) 1959. (*University of Pennsylvania School of Medicine, Philadelphia)

The authors contend that the problem of suicide is of greater dimensions than the current interest in it would imply. Suicide is the 11th leading cause of death in the United States, and studies in Philadelphia indicate that for every successful suicide attempt there are five additional attempted suicides which become matters of police action. There are additional cases of suicide which are not so dealt with and may be labeled in other ways. Successful suicide attempts account for 17,000 deaths per year in the United States, an incidence of 10 per 100,000, and in a Philadelphia survey it was found that 77% of successful suicides had been under medical care. The emergency treatment of suicide is discussed including the role of the psychiatrist.

There are suicide control programs in London and in New York, whereby a person fearing that he may be tempted to commit suicide may contact the police or public health authorities for assistance. The law is discussed, and there is reference to the problem of workman's compensation, "If a person's suicide is connected with a mental disorder arising from an accident at work and the act is carried out without conscious volition to produce death, the case is compensable. However, if the person had the ability to recognize the purpose and the physical effect of the act, then the chain of causation is broken" (Guttmacher, M. S., and Weihofen, H.: Psychiatry and the Law, New York, W. W. Norton & Company, Inc., 1952).

Internal Harmony: Its Definition for the Modern Company. W. G. Scott.* Advanced Management 24:20 (Aug.) 1959. (*Georgia State College of Business Administration, Atlanta, Ga.)

Scott points out that equilibrium has become a dogma in human relations. Of more importance, however, is the fact that equilibrium is a term borrowed from the physical sciences which is basically not applicable to human relations. In the physical sciences, equilibrium postulates that a system, once it has undergone change, will tend to return to its original state. The author contends that social systems do not behave in this manner. Equilibrium tends to lead to mechanical thinking, as though once the "social mechanics" are identified, all will be well. Furthermore, equilibrium has become associated with the "group think" movement so that "the indivdual should be dissolved in the group so all may gain the same level of mediocre adjustment."

In opposition to the concept of equilibrium, Scott offers the concept of harmony. Harmony has a normative connotation and implies that a condition of harmony is good from the standpoint of the employee and of the organization. He defines it as a condition in the company "where there is accord among the objectives of individuals, the informal organization, jobs and the formal organization." This harmony is the responsibility of the line organization and not of the staff. There has

been a recent practice for human relations programs to simply be new slogans or names for traditional personnel functions.

NOTE: In the opinion of this reviewer, harmony itself may be also an overly simplified concept, but it certainly appears to be less mechanical and more satisfactory than the concept of "equilibrium" as applied to the industrial organization.

Radiation Health

W. Daggett Norwood, M.D.

Deposition of Strontium-90 Through October 1958. M. Eisenbud.* Science 130:76 (July 10) 1959. (*New York Operations Office of the U. S. Atomic Energy Commission, New York)

Fallout in the North Temperature Zone during the three years since 1956 has been higher than average for all latitudes and appears to demonstrate preferential deposit from the stratosphere. The author estimates an increase in global deposition from 1.9 to 2.6 megacuries of strontium-90 during the period from June, 1957, to October, 1958. For the New York area the strontium-90 content of milk appears to be increasing in proportion to the strontium-90 content of the soils from which the cows derive their forage. If one assumes that this proportionality will continue until all of the strontium-90 from the upper atmosphere has been deposited, a child deriving its calcium from dairy sources may be expected to develop a skeleton having 5.5 micromicrocuries of strontium-90 per gram of calcium. This is considered to be a conservative estimate. It is double that made in June, 1957, and reflects the increased stratospheric inventory due to the Russian detonations in 1958. "A skeletal burden of 5.5 micromicrocuries of strontium-90 per gram of calcium will deliver a dose of approximately 5.5 millirems per year to the bone marrow." The dose to the skeleton from natural sources is approximately 125 millirems. "The maximum foreseeable dose from strontium-90 in the New York area is thereby estimated to be about five per cent of the dose due to natural radioactivity."

Unusual Localization of Incorporated Radioisotopes and Their Radiobiological Aspects. E. H. Graul.* Atompraxis 26:173 (April-May) 1959. (*Department of Radiobiology and Radioisotopes, Radiation Institute, University of Marburgh/Lahn, Germany)

This article summarizes a series of observations based on autoradiographic studies showing the nature of the distribution of various radioisotopes in the animal body, including the microscopic area. In arriving at the maximum permissible concentration of radioisotopes, factors are used to account for the uneven distribution of the radioisotope within the body and within the critical organ and for the relative biological effectiveness of the radiation. The study indicates much variability in the distribution of radioisotopes in animals. It also demonstrated that many radioisotopes, differing from one another both chemically and physically, reappear in the alveolar lumen of the lung following intraperitoneal or intracardiac injection. This indicates the importance of the lung as an organ of excretion. In light of the facts presented, the author indicates that there is a considerable factor of uncertainty in presently recommended MPC values, and that "in using radioisotopes it is our duty to remain as far under the MPC values as possible."

Fetal Irradiation and Fallout. J. Schubert.* Bull. Atomic Scientists 15:253 (June) 1959. (*Argonne National Laboratory, Box 299, Lemont, Ill.)

In a carefully controlled study, Stewart, Webb, and Hewitt attempted to tabulate all children in England and Wales who died of leukemia or cancer before their 10th birthday during the years 1953-1955. The mothers of 1,416 such children, and a similar number of mothers of well children were interviewed by a "survey doctor." They found that the death rate from malignant disease for children who had been x-rayed in utero was about twice as great as that of the control group, who had not received such exposure. The radiation was received during the third trimester of pregnancy and was estimated to average 2 r. While the individual exposures are subject to considerable variation, the findings suggest that radiation so low as to approach the radiation levels from fallout and natural background may cause a statistically significant increase in childhood deaths from malignant disease. On this basis the author estimates that present levels of fallout ($\approx$20 mr to the fetus) may cause an increase of about 1% in the number of deaths from all types of malignant disease, including leukemia in children in the 0-10 year age group. He similarly estimates that natural background radioactivity may be responsible for about 5% of all deaths due to malignant disease in the 0-10 year age group. These estimates assume that a proportionality for radiation effects on the fetus exist in the 20 mr to 2 r dose range and that no dependency on dose rate exists. In the U. S. about 3,000 children in the 0-10 year age group now die of all types of malignant disease annually, and leukemia contributes about 50% of this total. Therefore, the 1% estimate, as possibly due to fallout, would equal 30 deaths due to all types of malignant disease, while natural background could cause 150 deaths. This suggests that ionizing radiation itself is probably not a major cause of leukemia and other malignant disease in childhood. Based on an estimate that 11% of U. S. children are subjected to irradiation in utero from diagnostic x-ray pelvimetry, this could account for 400 of the 3,000 cancer deaths in the 0-10 age group. This emphasizes the necessity of continued effort to reduce the per cent of roentgen examinations of

the pelvis during pregnancy. Experiments for determining the effects of very low dosages and low dose rates of radiation might well be focused on a program in which the fetuses of laboratory animals are exposed to momentary radiation during a period corresponding to the last trimester of the human gestation period.

Internal Medicine

John J. Thorpe, M.D.

Relationship Between Diuretic and Antihypertensive Effects of Chlorothiazide and Mercurial Diuretics. W. Hollander,* V. Chobanian, and R. W. Wilkins. Circulation 19:827 (June) 1959). (*Robt. Dawson Evans Memorial Department of Clinical Research and Preventive Medicine, Massachusetts Memorial Hospitals, Boston)

Hypertensive patients on a controlled sodium intake of 9 to 210 mEq. per day showed a significant drop in blood pressure following administration of chlorothiazide orally and intravenously and mercurial diuretics parenterally when compared with control normotensives. These changes in blood pressure were associated with a negative sodium and potassium balance. When fluorohydrocortisone was added to chlorothiazide, lowering of the blood pressure was also observed, though body sodium was not reduced. The natriuretic and hypotensive effects of chlorothiazide were increased by the addition of SC-8109, a steroidal lactone, to chlorothiazide.

The findings that chlorothiazide and parenteral mercurial diuretics have a hypotensive action in subjects with arterial hypertension but not in normal persons suggest that these compounds may operate similarly against some arterial pressor mechanism.

Fibrinolytic (Plasmin) Therapy of Experimental Coronary Thrombi with Alteration of the Evolution of Myocardial Infarction. Paul Ruegsegger, Irwin Nydick, Robert C. Hutter, Alvin H. Freiman, Nils U. Bang, Eugene E. Cliffton, and John S. LaDue, Circulation 19; (Jan.) 1959. (*Clotting Mechanism Section of the Division of Metabolism and Enzyme Studies, Sloan-Kettering Division of Cornell University Medical College and the Department of Cardiology, Memorial Center, New York)

Human plasmin (fibrinolysin) is an enzyme that has been shown to be effective in the dissolution of clots in peripheral vessels. The effect of infusing 4,000 mg per kilogram per hour of plasmin on coronary thrombi induced in dogs was successful in 16 of 44 dogs studied. Coronary thrombi persisted in seven of eight control animals. The remaining control dog demonstrated spontaneous fibrinolytic activity, with disappearance of the thrombus. In eight dogs with induced fibrinolytic activity, total lysis of the coronary thrombus was achieved in four within three to seven hours. Partial lysis of 60 % or more occurred in the other four treated animals. Anatomic study of plasmin-treated infarcts showed less vascular congestion and edema and decreased fibrinous epicarditis. There was a complete absence of microthrombi in the treated animals compared to the frequent occurrence of these lesions in the control dog hearts.

The authors feel that this experimental evidence offers a sound rationale for a trial of fibrinolytic therapy of human myocardial infarction. With the recent development of purified preparations of plasmin for human use, such a study is now possible.

Graphic Recording of the Korotkoff Sounds. L. A. Geddes,* W. A. Spencer, and H. E. Hoff. Am. Heart J. 57:361 (March) 1959. (*Departments of Physiology and Rehabilitation, Baylor University College of Medicine, Houston, Texas)

A relatively simple, inexpensive graphic recorder of systolic and diastolic blood pressure for use by clinicians, physiologists, and pharmacologists is described. A combined cuff-sound detector unit was designed in which a miniature acoustic pick-up was installed. This consisted of a piezocrystal from an inexpensive phonograph cartridge mounted in the distal third of the cloth cuff. A simple sound preamplifier pressure-transducer unit was constructed, which when connected to the cuff for pressure and the crystal for sound, produces a combined output signal superimposing the auscultatory sounds on the cuff pressure. A single stage of push-pull amplification for the sounds and a photoelectric Burbon tube pressure transducer require only a two-stage direct coupled amplifier to drive the recording pen.

In operation, the cuff is installed in the conventional manner with the sound detector distal to and over the compressed artery. As the cuff pressure is reduced from above systolic, the recording pen falls. When systolic pressure is reached, sound spikes appear on the graphic record. These disappear as phase V (silence) of the Korotkoff spectrum is reached.

Useful applications in recording blood pressure readings on children, small animals, or patients in inaccessible environments are cited.

Medical Care Administration

Asa Barnes, M.D.

Group Health Plans, A Twenty Year Legal Review. H. R. Hansen.* Minnesota Law Rev. 42:527 (March) 1958. (*St. Paul, Member of the Minnesota Bar.)

The financial side of medical practice has seen many innovations and changes in the past 20 years as organizations of people have pressed for better methods of meeting the rising cost of better medical care. Along with these changes have come adjustments in the law. Group health plans have proved their worth and are spreading. Labor health and welfare funds are giving these plans great impetus. As this activity grows there are bound to be conflicts and litigation. In this article the law basic

to the issues is reviewed. In the past 20 years group health plans have prevailed in such lawsuits without exceptions.

The common law prohibition against corporate practice of medicine does not apply to a nonprofit plan. The insurance statutes do not apply if the plan provides medical service instead of cash indemnity. Attacks by organized medicine can be fully met with a strong body of antitrust laws. No sharper rebukes appear in any antitrust decisions than in those cases where organized medicine is taken to task for using ethics as an economic weapon.

The courts have shown great concern for the public health, and by their decisions have indicated great impatience with any interests standing in the way of its betterment.

How Health Needs of the Aged are Met in Colorado. T. M. Tierney.* Hospitals, J.A.H.A. 33:40 March 1, 1959. (*Executive Director, Colorado Hospital Service, Denver.)

In Colorado, as a part of the old-age pension plan, the state has set aside $10,000,000 of its tax revenues to provide a health care program for its pensioners. The program provides coverage for 54,000 persons and is administered for the state by Colorado Blue Cross-Blue Shield.

The program provides coverage on a full service benefit hospital coverage in any licensed general hospital in the state. The pensioners have full surgical coverage and full in-hospital medical coverage provided on a service benefit basis by the medical profession. They are also given nursing home care following acute hospitalization and medical care in the nursing home.

There are those in Colorado who disagree with Blue Cross-Blue Shield participation in these programs as they feel that they are furthering the cause of compulsory health insurance or socialized medicine. Some think it constitutes endorsement of the philosophies involved in legislation such as the Forand Bill. There are those who would maintain the status quo, that existed in the practice of medicine 20 or 30 years ago. Times have changed, the role of the voluntary hospital has changed, the method of practicing modern medicine has changed, the economic structure of our society has changed, and the desires and demands of all segments of our population for adequate health care have changed. These health funds exist; the only question is how they are to be administered. These people are now receiving adequate basic hospital-medical-surgical care.

Businessmen Look at Employee Health Services. Editorial, Am. J. Pub. Health 48:229 (Feb.) 1958.

How much does a health service cost and what are the returns? This is what management looks at, and much depends upon attitudes and information on this subject. The Institute for Social Research, University of Michigan, recently conducted a survey for the U. S. Public Health Service in which interviews were held with executives of 262 business enterprises employing from 50 to more than 500 persons. The findings suggest what kinds of information are likely to be effective.

Most businessmen agree that employee health is important and would like more information on the subject. Businessmen who do not employ a doctor or a nurse look on a health service as concerned solely with treatment of injured employees. There is no awareness of gains to be derived from preventive activities, good employee relations, or possible savings in sick leave cost.

The best source of health information is talking with other managers. The next is talking with industrial physicians and with workmen's compensation carriers. Establishments with 250 or more employees and those with a policy of providing sick leave are most likely to be persuaded to organize employee health services. Failure to have health service is due not so much to resistance to the idea as to lack of information about costs and values of employee health services.

Industrial Hygiene

Edward C. Riley, M.D.

Engineering Estimates of Atmospheric Dispersal Capacity. H. E. Cramer.* Am. Indust. Hyg. A. J. 20:183 (June) 1959. (*Massachusetts Institute of Technology, Cambridge.)

"Recent empirical investigations have significantly increased the fundamental knowledge of small-scale dispersal mechanisms. These studies provide, for the first time, a comprehensive picture of the variations in basic diffusion parameters in all thermal stratifications. In addition, analyses of these data have led to a new technique for estimating the dispersal of air borne contaminants based on the direct meteorological indicators. Estimates obtained by this method are believed sufficiently accurate to provide a basis for resolving many industrial air-pollution problems."

Although air pollution may be a minor part of an industrial hygienist's or industrial physician's program, it is important to know something of the capacity of the atmosphere as a disposal medium for small-scale processes in order to advise management as to the necessity for expensive collection systems.

"The material presented . . . is intended to provide a suitable base for engineering estimates of small-scale atmospheric dispersal. Many of the numerical results are approximately midway between estimates previously obtained from formulas of O. G. Sutton and Bosanquet and Pearson. This is interpreted as an indication that considerable confidence may be placed in predictions of the dispersal of air-borne material."

A Study of the Morin Method for the Determination of Beryllium. J. Walkley.* Am. Indust. Hyg.

Abstracts

A. J. 20:241 (June) 1959. (*Massachusetts Institute of Technology, Cambridge.)

"In view of the increased use of beryllium in industry and the extremely small amounts which must be determined in air and biological materials for evaluation of the environment, a rapid, sensitive method making use of readily available reagents and instrumentation is desirable." This method makes use of the Beckman DU spectrophotometer with fluorescence attachments. "Other commercially available instruments with properly adapted illumination and filter systems may well be applied. . . . The method of treatment of air samples varies with the type of collecting medium." Various types of collection media have been used, including filter paper samples, such as the Whatman and Hollingsworth and Vose H-93, Mine Safety Appliances Type S unimpregnated pleated filters, and Millipore filters.

A study of several types of interferences was made and the sensitivity tested against spiked samples. "A method is presented for the fluorimetric determination of beryllium with morin which is sensitive to 0.004 μg of beryllium in an aliquot of 0.02 μg per sample. With 0.01 μg beryllium in an aliquot there is no interference from 100 μg of calcium, copper, fluorine, iron, magnesium, phosphate, titanium, uranium, and zirconium. At a concentration of 100 μg, zinc gives a fluorescence equivalent to 0.004 μg of beryllium but does not interfere at a level of 75 μg. Recoveries of beryllium from spiked samples show that the method is satisfactory for the tolerances and ranges encountered in air sampling procedures, and results of typical field samples are shown."

Vapor Phase Chromatography in Quantitative Determination of Air Samples Collected in the Field. R. H. Mansur,* R. F. Pero, and L. A. Krause. Am. Indust. Hyg. A. J. 20:175 (June) 1959. (*Virginia Department of Health, Richmond.)

This paper describes an adaptation of vapor phase chromatography to the quantitation of air samples obtained in the field. The authors point out the need for more specific identification of solvent vapors when confronted with exposures to vapors from mixed solvents varying in volatility as well as toxicity. In any field sampling equipment, the element of portability is considered. "The problem, therefore, may be stated as follows: To develop a method of quantitative determination of solvent vapors in air that is accurate, rapid, completely specific, and employs a single uncomplicated air sampling technique." Chamber concentrations of 50, 100 and 200 ppm of toluene were set up and impinger samples were collected. Varying amounts of the sample were injected into the Fractometer, and both peak height and area under the peak were measured. Although there was no direct proportionality between the methyl alcohol peak and the toluene peak, under a given set of conditions, curves could be prepared or nomograph plotted for the measurement of any given solvent.

This method was again tested by a "blind" sampling technique. It was found that the maximum error on the basis of one instrument run was ± 10%. If three to five instrument runs are used, the error is consistently with ± 5% at all concentrations studied. This degree of accuracy is considered fully adequate for practical industrial hygiene use."

The authors conclude that in the present stage of development, the method is usable from the standpoints of accuracy, specificity, time requirement, and cost. It is emphasized, however, that certain features of the method should have further study. "It is also believed that the . . . general principles of the method can be modified to fit numerous other needs of the industrial hygiene profession."

Experimental Toxicology

R. E. Eckardt, M.D.

Carcinogenic Effects of Petroleum Asphalt. M. H. Simmers,* E. Podolak, and R. Kinosita. Proc. Soc. Exper. Biol. & Med. 101:266 (June) 1959. (*College of Osteopathic Physicians and Surgeons, Los Angeles)

Six samples of asphalts, straight-run and oxidized, from Western U.S. crude oils refined in Southern California, were pooled and tested for carcinogenicity on C-57 black mice. Liquefied in benzene, the asphalt was painted twice weekly on the interscapular region of 68 mice; 0.2 ml of a 1% suspension of asphalt in olive oil was injected subcutaneously into the same region of 62 mice twice weekly. Among the skin-painting group, 12 epidermoid carcinomas developed, the first appearing after 54 weeks of treatment. Eight sarcomas (one rhabdomyosarcoma and seven fibrosarcomas) appeared at injection sites, one of which was successfully transplanted. The first sarcoma in this group appeared after 36 weeks of injection; no distant metastasis has been seen. No tumors have developed in the control groups receiving benzene skin paints or olive oil injections.

Effect of Carbon Tetrachloride Poisoning on Potassium, Sodium, and Water Content of Liver Mitochondria. L. Share* and R. O. Recknagel. Am. J. Physiol. 197:121 (July) 1959. (*Western Reserve University School of Medicine, Cleveland, Ohio)

A physiological test which measures the ability of the mitochondria to concentrate potassium in vitro, was used in a study of CCl_4-induced hepatotoxicity. The force feeding of CCl_4 resulted in a reduction in the K content of rat liver mitochondria, impairment in the ability of K-depleted mitochondria to reaccumulate K, and an increased water content of the mitochondria. The changes could be

demonstrated unequivocally at 10.5 hours and were extensive at 20 hours. The results do not support the view that the increase in liver fat is the direct result of a mitochondrial lesion, since the time course of impairment in mitochondrial K and water metabolism lags behind the fatty changes of the whole liver.

Studies on the Metabolism of Mercuric Chloride and Methyl Mercury Dicyandiamide. L. Friberg.* A.M.A. Arch. Indust. Health 20:42 (July) 1959. (*National Institute of Public Health, Stockholm, Sweden)

In rats given daily subcutaneous doses of 1 mg per kilogram of Hg_{203}-labeled mercuric chloride or Hg_{203}-labeled methyl mercury dicyandiamide for 10 days, about 100 times as much Hg was found in the blood, about 10 times as much was present in the cerebrum, cerebellum, brain stem and spleen, and about twice as much was present in the liver of the organic mercury group than in the inorganic group. Conversely, renal values were about twice as high, 20 times as much Hg was excreted in the urine, and about twice as much was in the feces in the inorganic group as compared with the organic group. Studies of mercury excretion after dosing was stopped and of the extent of exchange of mercury between radioactive and nonradioactive compounds indicated that organic mercury was more firmly bound to tissues. Some *in vivo* exchange of Hg between the organic and inorganic compounds was demonstrated. In the blood it seemed that the organic compound inhibited loss of the inorganic compound.

Reparative Surgery

Robert J. Trettin, M.D.

Management of the Donor Site. R. Anderson,* E. R. Dykes, and M. M. Martin. Cleveland Clin. Quart. 26:106 (July) 1959. (*Cleveland Clinic, 2020 E. 93rd St., Cleveland 6)

Every surgeon who performs skin grafting procedures must face the problem of how to manage the donor site. Every effort should be made to minimize both the discomfort to the patient and the residual scar.

Until recently, the almost universal method of handling the donor site has been to use a firm, occlusive dressing over some kind of gauze. Of the many materials which have been applied next to the raw surface, the most widely and successfully used has been of fine-mesh gauze, lightly coated with petrolatum, covered by a resilient pressure dressing.

The authors discuss a method of donor-site dressing which they have employed since 1952. This utilizes an occlusive dressing over fine-mesh petrolatum gauze for the first 12 to 24 hours. At that time the occlusive portion is removed and the fine-mesh gauze alone is left in place to become an integral part of the covering coagulum. The results when this method has been used have been superior to those obtained with the standard occlusive dressing.

The authors report that in the past seven years approximately 1,400 donor sites have been managed by this gauze-coagulum method. There has been no instance in which the entire donor site has become wet, even in the uncooperative patient, and the over-all incidence of complications requiring treatment is less than 5%.

Experimental Investigations of Ligamentous Healing. M. L. Clayton, and G. J. Weir Jr. Am. J. Surg. 98:373 (Sept.) 1959. (*University of Colorado School of Medicine, Denver)

Following severe injury with complete rupture of a ligament, instability of the joint often occurs because the ligament fails to heal with proper length and strength.

The classic method of initial therapy has been rest and immobilization, usually by plaster cast, followed by exercise of the affected joint. Recently several reports have advocated early operation to suture the torn ligament.

The authors used 13 mongrel dogs in this study to compare the tensile strength and microscopic picture of divided ligaments treated by simple immobilization and by suture. Their conclusions were as follows:

1. Ligaments which have been divided and immobilized heal with a gap of fibrous tissue between their cut ends.
2. Ligaments which have been divided and have had the cut ends approximated by suture heal by union of the ligamentous fibers without a gap.
3. Sutured ligaments are stronger at all test periods than unsutured controls.
4. After six weeks the suture line cannot be disrupted, as the ligament parts through a normal area. The suture line is no longer the weakest link in the chain.
5. For a period of nine weeks all unsutured ligaments disrupt through the line of previous section. The line of division is still the weakest link in the chain.

Failures of Homografts as Arterial Replacements. J. A. DeWeese,* W. D. Woods, and W. A. Dale. Surgery 46:565 (Sept.) 1959. (*University of Rochester School of Medicine, Rochester, N. Y.)

With the renewed interest in the direct surgical approach for the treatment of arterial disease during the past 10 years, homografts have probably been the most widely used replacements for blood vessels. The increasing number of reports of homograft complications prompted the authors to scrutinize the fate of 90 homografts used from the Blood Vessel Bank at Strong Memorial Hospital between May, 1955, and May, 1958.

Eight complications directly attributable to the use of homografts as arterial replacements are presented. These include aneurysmal dilatation,

rupture, rupture into the intestine, thrombosis, and infection. Thirty similar cases have been collected from the literature. The incidence of such complications has ranged from 1.6% to 8.9% in experiences with large numbers of homografts. Microscopic examination of 26 homografts which had been in place for periods up to 26 months showed elastic tissue degeneration in some of the older specimens which could not have been predicted by examination of the original homografts.

The morbidity and mortality resulting from these complications would have been avoided by the use of synthetic prostheses for aortic replacements and autogenous veins or synthetic prostheses for peripheral arterial replacements.

Dermatology

Raymond R. Suskind, M.D.

Contact Dermatitis from Hydrazine Hydrochloride in Soldering Flux: Cross Sensitization to Apresoline and Isoniazid. J. Frost and H. Hjorth. Acta dermat. venerol. 39:82-86 (Aug.) 1959. (*University Clinic of Occupational Diseases, Copenhagen, Denmark)

The authors describe an outbreak of an eczematous dermatitis which occurred in 12 of 34 women employed in soldering tinplate in a Copenhagen plant. The flux which was implicated was an aqueous solution of hydrazine monohydrochloride ($N_2NNH_2.HCl$) and stannous chloride ($Sn\ Cl_2.2H_2O$) employed in a dilution of 1:4. Despite the known irritant capacity of the new solder flux, it was handled without benefit of gloves or local ventilation.

Positive patch test reactions were evoked in six of the 12 cases with 1% hydrazine sulfate. Thirty control patients, with dermatitis from other causes, had negative reactions when patch-tested with the same material. In one case there were also positive patch test reactions to apresoline, phenylhydrazine and isoniazid. The authors believe that their observations demonstrate that hydrazine monohydrochloride, when used as a solder flux, may cause allergic contact dermatitis as well as cross sensitization with the above-named drugs.

Multiple Factors in the Causation of Diseases. M. B. Sulzberger.* Dermatologica 117:407 (Dec.) 1958. (*New York University, Department of Dermatology, New York)

The concept of multiple causative factors and its implication in the understanding and management of cutaneous disease is presented. Common examples are cited such as recurrent herpes simplex in which (1) the dormant virus in epidermal cells and (2) the numerous stimuli which will provoke viral growth such as fever, ultraviolet light, trauma, foods, drugs, and even emotional stress, must be present in order for local blistering to occur. Another example cited is acne vulgaris, in which therapy must be directed against each of the separate provoking factors. The author makes a plea for the integrated approach in the management of skin diseases. This approach requires that the knowledge of several disciplines be applied diagnostically as well as therapeutically, e.g., hematology, bacteriology, mycology, endocrinology, etc. In many instances the disease process is such that various branches of medicine "must collaborate to discover as many as possible of the different links of the chain that has produced the sickness . . . and that group of physicians must collaborate in striking at each and every potential link of the pathogenetic chain with all the force which modern medicine and science is able to supply." The effective use of the collaboration of medical and other scientific disciplines in the management and prevention of disease has reached its highest level of realization in occupational medicine.

Partial Alopecia Due to Thallium. W. R. Hubler.* A.M.A. Arch. Dermat. 80:223 (Aug.) 1959. (*1510 Brownlee Ave., Corpus Christi, Texas)

In the past two and one-half years 40 cases of thallium poisoning in small children were reported in the Corpus Christi area. These occurred in children who ingested a cake-crumb roach killer containing thallium. The author observed slight to moderate alopecia in 13 of his own cases. More recently he has seen women with diffuse alopecia in whose urine thallium was detected by spectoscopic examinations. None of these used insect poisons containing thallium. The local health department suggested several possible sources of thallium intake for these women: (1) ingestion of bread made with flour which might have been accidentally contaminated with a thallium insecticide; (2) thallium insect powder present on the surfaces of food cans, and (3) contact with, or ingestion of, thallium used by professional exterminators. The author suggests that unexplained hair loss in adults might be due to accidental and unsuspected thallium ingestion.

Occupational Eczema Due to *p* Tertiary Butyl Phenol in a Shoe Adhesive. K. E. Malten.* Dermatologica 117:103 (Aug.) 1958. (*Netherland Institute for Preventive Medicine, Leyden, Holland)

An outbreak of severe dermatitis in shoemakers is described. This problem was traced to a new adhesive which contained a phenol-formaldehyde resin composed of *p*-tertiary butyl phenol, formaldehyde, and an unidentified catalyst. The resin in question is a polycondensation plastic which affords low molecular weight compounds which are considerably more sensitizing than the completely cured product. Of the 10 shoemakers patch-tested to the adhesive and its components, reactions were evoked in all of them with the complete adhesive, the phenol-formaldehyde resin and *p*-tertiary butyl phenol. Two operators demonstrated positive patch

tests to formaldehyde. Specific hygienic measures are suggested for the prevention of sensitization.

Cutaneous Hypersensitivity to Adhesive and Scotch Tapes. J. C. Murphy,* A. E. Reif, and H. L. January. J. Invest. Dermat. 31:45 (July) 1958. (*Lovelace Clinic, Albuquerque, N. Mex.)

The case history of one of the authors is recounted in which severe eczematous reactions were noted following the application of both surgical adhesive tape and Scotch tape. Patch tests were performed with coded samples of 20 constituents of the surgical tape and 8 constituents of the Scotch tape. Severe reactions were elicited to samples of diamyl hydroquinone, an antioxidant used in both types of tape. The authors believe that in this instance the development of sensitization was enhanced by the frequent repeated stripping and reapplication of adhesive tape to the same skin for several days.

Dermatitis from Thermoplastic Tape. H. F. Kipping.* A.M.A. Arch. Dermat. 80:348 (Sept.) 1959. (*1275 Delaware Ave., Buffalo, N.Y.)

The case reported is one in which a dermatitis of the back developed three weeks after a janitor repaired his torn shirt with a thermoplastic tape patch. A positive reaction was elicited with the laundered tape. Although no chemical information was divulged by the manufacturer, the author suggests that in this instance the tape was presumably impregnated with a vinyl resin which was incompletely cured. The possible allergenic role of plasticizers and stabilizers is mentioned.

Clinical Toxicology

Lee H. Miller, M.D., I.M.D.

Pulmonary Disease Amongst Sisal Workers. H. Stott.* Brit. J. Indust. Med. 15:23 (Jan.) 1958. (*Labour Department, Kenya Colony)

This study was carried out in a factory in Kenya in which ropes and bags are made from sisal. The purpose of the study was to determine whether the dust from the operations produced pneumoconiosis or other chest diseases. An analysis of the records from the factory dispensary revealed that the respiratory illness sickness rate was twice as high in the card-room workers as in those working in other parts of the factory. Because of this, 93 workers were studied. Of them, 37 worked for 6 months or more in the card-room only; 27 worked for 10 years or more in other departments of the factory only; and 29 worked a total period of 2½ years in the factory, some of which was in the card-room. The average dust concentration in the card-rooms was 243 particles (0.5 to 5 μ) per milliliter. The deposited dust was found to have a low silica content. Of 37 workers in the card-rooms, with exposures varying between 6 months and 15 years, 4 had radiographs with a similar type of apical fibrosis, and 2 had radiographs that exhibited heavy lung markings. The films of workers of long experience in other parts of the factory did not show any cases of apical fibrosis, and only one had heavy markings. The radiologic findings of the four workers suggested chronic fibroid tuberculosis; bacteriologic examinations, however, were negative. Bronchiectasis was demonstrated in these persons also. The maximum breathing capacity was significantly lower in the card-room workers than that of workers in other areas of the factory. Allergic symptoms such as those that occur in byssinosis were not obtained, and skin sensitivity tests with sisal dust preparations failed to demonstrate sensitivity in any group of workers. A statistically significant association between the length of exposure and the radiological findings of apical fibrosis was found to exist. Because of these findings, the author states, it seems possible that the fibrosis is related to the occupation. Although the etiological agent was not elucidated, a fungus is suspected to be the most likely cause.

The Control of Industrial Bladder Tumours: A Code of Working Practice Recommended by the British Dyestuffs Industry for the Manufacture and Use of Products Causing Tumours of the Bladder. T. S. Scott and M. H. C. Williams. Brit. J. Indust. Med. 14:150 (July) 1957.

The premises that form the basis of this report are briefly these: The high incidence of bladder tumors has occurred in the manufacture or handling of beta-naphthylamine, benzidine, and alpha-naphthylamine. A widely variable latent period between entry to the industry and onset of the tumors exists. Development of a tumor is irreversible, and it is not arrested by cessation of exposure. Development of tumors and death occur at earlier ages in persons who enter the industry before the age of 30 than in entrants after the age of 40. The proportion of exposed persons who will be affected is related to the intensity and duration of exposure. The mean latent period is influenced by the type of carcinogen. Technical beta-naphthylamine is about twice as potent as benzidine and four times as potent as technical alpha-naphthylamine. Alpha-naphthylamine may be a carcinogen. Aniline does not cause tumors of the bladder. There is an occupational hazard of bladder tumor in the manufacture of auramine and magenta.

The disease is described, and the medical control measures are outlined clearly and completely. They consist of (1) maintenance of good plant and medical records; (2) careful selection of entrants for work with these materials; (3) proper education and training of the workers; (4) personal protective measures; (5) hours of work; and (6) limitation of numbers of workers exposed.

The second part of the report deals with the plant and operating precautions. Useful and practical notations concerning buildings, ventilation, various operational procedures, maintenance, and transport and packaging of the materials are discussed.

Abstracts

The final portion of the report points out the main and subtle dangers associated with certain manufacturing processes, and the handling of specific compounds that include beta-naphthalamine, tobias acid (2 naphthylamine-l-sulfonic acid), benzidine, benzidine azo colors, *o*-tolidine, dianisidine, dichlorbenzidine, alpha-naphthylamine, alpha-naphthylamine sulfate, alpha-naphthol, naphthionic acid, sodium naphthionate, phenyl-alpha-naphthylamine, ethyl-alpha-naphthylamine, rubber chemical manufacture from alpha-naphthylamine, alpha-naphthylamine condensation colors, phenyl-beta-naphthylamine, alpha-naphthylamine azo colors, auramine manufacture, magenta manufacture, and xenylamine.

Noise and Hearing

H. O. Parrack, Ph.D.

On the Halving and Doubling of the Loudness of White Noise. E. C. Poulton and S. S. Stevens.* J. Acoust. Soc. America 27:329 (March) 1955. (*Psycho-Acoustic Laboratory, Harvard Univ., Cambridge, Mass.)

Thirty-six subjects judged the apparent halving and doubling of the loudness of white noise which was presented at nine different sound pressure levels. The decibel change in sound pressure required to halve or double the apparent loudness was measured. The level of the noise was adjusted by the subjects, and they used a control whose angular turn was proportional to the loudness produced (sone potentiometer). Attempts were made to measure and control biasing factors of importance in estimating loudness. The median sound pressure level change in decibels required to produce a loudness ratio of 2:1 ranged between 6 and 10 approximately. This range of sound pressure levels for a constant loudness ratio demonstrates the difficulties and uncertainties in estimating the loudness of noise.

Apparent Reduction of Loudness: A Repeat Experiment. S. S. Stevens,* M. S. Rogers, and R. J. Herrnstein. J. Acoust. Soc. America 27:326 (March) 1955. (*Psycho-Acoustic Laboratory, Harvard University, Cambridge, Mass.)

Laird, Taylor, and Wille reported the first extensive experiment on the relation of loudness to the intensity of a sound. Audiometers, which had just become available, were used by these experimenters to generate the sounds. Most subsequent workers who attempted to construct loudness scales on the basis of all available data have found Laird, Taylor, and Wille's data to be out of line with those of most other experimenters. Since there were no explanations of the discrepancies, the out-of-line data have simply been neglected. The present experiments were designed to seek the source of discrepancies in the data. An audiometer similar to that available to Laird, Taylor, and Wille was used, and an effort was made to follow their methods of test. It was found difficult to judge half-loudness using the 5 db steps of the audiometer. However, the final analysis of the first group of experiments showed that the mean reduction for half-loudness was about half as many decibels as found by Laird, Taylor, and Wille. The use of the audiometer does not explain the discordant results. A second series of experiments were run to examine the methods used by Laird, Taylor, and Wille or to test the methods they could have used. Inexperienced subjects obtained results somewhat like those of Laird, Taylor, and Wille. Experienced subjects obtained results closer to those of other experimenters. It is concluded that better methods for estimating loudness are now available and that it is justifiable not to use the data of Laird, Taylor, and Wille in constructing loudness scales. The detailed data are given in one table.

Measurements of Hearing Acuity Among Submariners and Noise Levels in Working Compartments. J. C. Webster* and L. N. Solomon. J. Acoust. Soc. America 27:466 (May) 1955. (*Human Factors Division, U. S. Navy Electronics Laboratory, San Diego 52, Calif.)

A hearing survey was made on crew members of 15 boats using a recorded audiometric test. A noise survey of the testing areas showed that the masking noise present would prevent a "0" hearing loss reading at 500 and 1000 cus. A hearing loss for normal ears of 1 to 7 db for 500 cps and 1 to 3 db for 1000 cps is expected under the test conditions. Audiometric data were obtained for 1,053 submariners. The hearing losses of engineroom crewmen were compared with those of other crewmen and with those of non-noise-exposed persons from other sources. The noise levels of the engineroom frequently exceed the damage-risk criterion proposed by Rosenblith, Stevens, et al. The results can be summarized as follows: (1) submarine crewmen who have served on board 4.5 years or longer show greater hearing losses than men of the same age in the general population; (2) enginemen have greater hearing losses than other crewmen; (3) the effects of gunfire as well as engine noise may be important; (4) the hearing losses of enginemen are less than would be expected if their exposure consisted of a continuous series of 40-hour work week exposures; (5) enginemen who have served on board more than 6.5 years are aware of hearing difficulties; (6) as regards protection, the use of available ear plugs or ear muffs should provide adequate protection without adversely affecting voice communication.

Index to Volume I

January through December, 1959

This index consists of three parts. The subject index begins on this page and ends on page 675. In the authors index and the general section index, which appear on pages 675 and 676, the parenthetical matter following the page numbers indicates the month of issue. The abbreviations are: January (Jan); February (Fe); March (Mar); April (Ap); June (Je); July (Jl); August (Ag); September (S); October (O); November (N); December (D).

SUBJECT INDEX

A

Abdomen
—nonpenetrating trauma (abst.), 247
—trauma: diagnostic and prognostic factors (abst.), 525
Absenteeism
—comparison of lost time cases in railroad industry and steel mills (Halen), 203
—due to sickness, 474
Absorption: percutaneous (Suskind), 40
Academy of Medicine of Cincinnati
—code of professional relationships for practice of industrial medicine, 100
Accidents
—causation: psychological aspects (abst.), 411
Acetaldehyde: toxicology (Henson), 460
Acetic acid: toxicology (Henson), 343
Acetone: toxicology (Henson), 610
Acetronitrile
—accidental group exposure to (Amdur), 627
—mammalian toxicity (Pozzani et al.), 634
Acrolein: toxicology (Henson), 461
Aerosols
—and fine powders: particle-sizing method (abst.), 64
—bacterial and other: syringe device for studies (abst.), 130
—deposition in human subjects (abst.), 139, 193
—nasal sampling in experimental animals (abst.), 193
—sympathomimetic: effect of dust particles on excised guinea pig lungs (abst.), 625
Air pollution
—analytical methods for measuring concentration of toxic substances in industrial atmosphere (abst.), 466
—atmospheric dispersal capacity: engineering estimates (abst.), 663
—biological tests for exposure (abst.), 470
—correlations between exposure concentrations and concentrations in biological materials (abst.), 467
—fluorides (Cholak), 501
—irritant gases: method for determination of effects on tracheal cilia of living animals (abst.), 468
—large-volume electrostatic sampler (abst.), 64
—manganese: polarographic method for determining traces (abst.), 467
—petrol-vapor poisoning (abst.), 417
—relation of MAC's to permissible concentrations in urine (abst.), 463
—relation of site of collection of sample to concentration of toxic agent (abst.), 469
—solvents: equipment for continuous determination (abst.), 466
—vapor phase chromatography in quantitative determination of air samples collected in field (abst.), 664
Alcohol
—allyl: acute and chronic toxicity (abst.), 139
Alcohol—continued
—allyl: vapor toxicity in laboratory animals (abst.), 576
—ethyl: carbon monoxide and: summating effects (abst.), 576
—ethyl: effect of acute intoxication on liver and plasma lipid fractions of rat (abst.), 67
—methyl: biochemical lesions in blindness due to (abst.), 358
Alcoholism
—in industry (abst.), 133
—labor's viewpoint on, in industry (abst.), 133
—management and problem drinker (abst.), 567
Aldehydes: aliphatic: toxicology (Henson), 457
Allergy: to air-borne castor-bean pomace (abst.), 520
Allyl chloride: vapor toxicity in laboratory animals (abst.), 576
Alnor Velometer: calibration (abst.), 250
American Academy of Occupational Medicine (editorial), 125
American Academy of Ophthalmology and Otolaryngology: Committee on Conservation of Hearing: guide for evaluation of hearing impairment, 167
American College of Chest Physicians: postgraduate course on diseases of chest, 124
American Industrial Hygiene Association to withdraw from Industrial Health Conference, 655
American Medical Association
—Commission on Medical Care Plans: report (O'Connor), 163
—Council on Industrial Health, 179
American Standards Association: standards used in establishing MAC's of concentrations of toxic dusts and gasses (abst.), 463
Amine boranes: toxicology (Roush), 49
Amines
—aromatic: benzidine metabolism (abst.), 243
—aromatic: carcinogens in industry (abst.), 144
Anemia, aplastic: industrial vs. therapeutic chemicals in etiology (Fleming), 97
Angina pectoris: observations on classic form (abst.), 415
Anthracosilicosis: tests in sarcoidosis and (abst.), 196
Anthrax, occupational, in United States (Kendall), 174
Antibiotics: use in large-bowel preparations (abst.), 41
Anticholinesterases
—organophosphate: oximes of diquaternary alkane salts as antidotes (abst.), 359
—recognition and detection in field and hospital (abst.), 73
—Sarin, new agent: penetration into skin (abst.), 70
Argonne National Laboratory: reactor criticality accident, 424
Arsenic
—inhaled: uptake, distribution, and absorption (abst.), 140
—urinary levels as index of industrial exposure (abst.), 64
Arteriography: in diagnosis and localization of acute arterial injuries (abst.), 191
Atomic energy
—hazards of radiation (abst.), 311
—statistical analysis of reactor safety standards (abst.), 352
—accidents: milk contamination in Windscale incident (abst.), 353
Atomic Energy Commission: fellowships in industrial hygiene, 11
Audiometer
—Bekesy-type: evaluation of operating conditions (abst.), 189
—Bekesy-type: variables on (abst.), 190
Audiometry: military (abst.), 135
—monitoring: medical principles (abst.), 75
Aviation medicine
—space flight: physiological problems (White & Wilson), 207
—terminal operations of Boeing 707 transport aircraft (abst.), 622
—vibration and noise problems in manned space craft (abst.), 621

B

Back: problem back (abst.), 195
Bagassosis: pulmonary function in, and results of adrenal steroid therapy (abst.), 186
Benzene
—poisoning, experimental: endocrine organs in (abst.), 526
—toxicology: modifications of erythropoiesis (abst.), 528
Beryllium
—control of neighborhood contamination near plant using (abst.), 309
—control problems in operations using compounds (abst.), 309
—disease: case (abst.), 192
—disease: review of current knowledge (Hardy & Tepper), 215
—disease, chronic, of lungs: radiological abnormalities (abst.), 308
—hazard evaluation and control in research and developmental operations (abst.), 309
—machining: control of operations (abst.), 309
—poisoning: chelating agents in therapy (abst.), 618
—processes using: problems in safe operation (abst.), 309
—processing plant: problems in control of operations (abst.), 309
—registry: evaluation of exposure data in (abst.), 309

Beryllium—continued
—toxic compounds: U. S. proposed safe levels (abst.), 464
Bladder: control of industrial tumors of (abst.), 667
Blood components in dog (abst.), 527
Blood vessel surgery, major, for traumatic injury (Roberts), 101
Books
—Adams, S., and Rogers, F. B.: Guide to Russian Medical Literature, 181
—Air Pollution Measurements of National Air Sampling Network, 1953-57 (U. S. Department of Health, Education and Welfare), 300
—Alcoholic Worker: National Industrial Conference Board Studies in Personnel Policy, No. 166, 407
—Alcoholism (Pfeffer), 513
—Appraisal Interview (Maier), 565
—Atomic Industry 1958, 349
—Atomic Power (editors of Scientific American), 128
—Chemistry of Industrial Toxicology (Elkins), 616
—Claus, W. D., editor: Radiation Biology and Medicine: Selected Reviews in Life Sciences, 566
—Clinical Epidemiology (Paul), 476
—Cooper, W. C., and Cralley, L. J.: Pneumoconiosis in Diatomite Mining and Processing, 242
—Covalt, D., editor: Rehabilitation in Industry, 299
—Current Concepts of Positive Mental Health (Jahoda), 565
—Dangerous Properties of Industrial Materials (Sax), 514
—Elkins, H. B.: Chemistry of Industrial Toxicology, 616
—Engineering Control of Health and Safety Hazards in Uranium Mines (Westfield et al.), 128
—Greenewalt, C. H.: Uncommon Man: Individual in Organization, 407
—Guide to Russian Medical Literature (Adams & Rogers), 181
—Habbe, S.: Alcoholic Worker: National Industrial Conference Board Studies in Personnel Policy, No. 166, 407
—Handbook of Organic Industrial Solvents, 407
—Hargreaves, G. G.: Psychiatry and the Public Health, 658
—Harris, S. J., editor: Impact of Peaceful Uses of Atomic Energy on State and Local Governments, 349
—Harris, S. J., editor: State Activities in Atomic Energy, 349
—Hazlett, T. L., and Hummel, W. W.: Industrial Medicine in Western Pennsylvania 1850-1950, 60
—History of Industrial Chemistry (Taylor), 658
—Impact of Peaceful Uses of Atomic Energy on State and Local Governments (Harris, ed.), 349
—Index of Occupational Health and Safety Laws, Codes, Rules and Regulations, by State and by Subject, 407
—Industrial Environment—Its Evaluation and Control (U.S.P.H.S.), 181
—Industrial Hygiene and Toxicology, Second Revised Edition, Vol. I—General Principles (Patty, ed.), 239
—Industrial Medicine in Western Pennsylvania 1850-1950 (Hazlett & Hummel), 60
—International Standard Classification of Occupations (International Labor Office), 615
—Jahoda, M.: Current Concepts of Positive Mental Health, 565
—Maier, N. R. F.: Appraisal Interview, 565
—New Chemistry: selection of articles from *Scientific American*, 61
—Patty, F. A., editor: Industrial Hygiene and Toxicology, Second Revised Edition, Vol. I—General Principles, 239
—Paul, J. R.: Clinical Epidemiology, 475
Books—continued
—Pendergrass, E. P.: Pneumoconiosis Problem, with Emphasis on Role of Radiologist, 300
—Pfeffer, A. Z.: Alcoholism, 513
—Pneumoconiosis in Diatomite Mining and Processing (Cooper & Cralley), 242
—Pneumoconiosis Problem, with Emphasis on Role of Radiologist (Pendergrass), 300
—Principles of Administration Applied to Nursing Services, 659
—Psychiatry and the Public Health (Hargreaves), 658
—Radiation Biology and Medicine: Selected Reviews in Life Sciences (Claus, ed.), 566
—Readings in Medical Care (Committee on Medical Care Teaching of Association of Teachers of Preventive Medicine, eds.), 60
—Rehabilitation in Industry (Covalt, ed.), 299
—Rehabilitation of Cardiovascular Patient (White et al.), 615
—Sax, I.: Dangerous Properties of Industrial Materials, 514
—State Activities in Atomic Energy (Harris, ed.), 349
—Taylor, F. S.: History of Industrial Chemistry, 658
—Uncommon Man: Individual in the Organization (Greenewalt), 407
—Westfield, J.; Flinn, R. H.; Look, A. D.; and Morgis, G. G.: Engineering Control of Health and Safety Hazards in Uranium Mines, 128
—White, P. D.; Rusk, H. A.; Lee, P. R.; and Williams, B.: Rehabilitation of Cardiovascular Patient, 615
—Working Abroad: Discussion of Psychological Attitudes and Adaptation in New Situations, 475
Boranes: See Boron hydrides
Boron hydrides
—intoxication in man (abst.), 143
—toxicology (Roush), 46
Brachial plexus block for hand surgery (Ditzler & Clifford), 363
Bromine: penetration in cells of central nervous system (abst.), 575
Brucellosis, laboratory-acquired (abst.), 358
Burns
—Management of burned hand (abst.), 192
—skin-grafting (abst.), 41
Byssinosis: epidemiology (Schilling), 33

C

Cadmium
—oxide fume: follow-up study of men exposed to (abst.), 523
—poisoning, chronic: proteinuria after comparatively short exposure to cadmium dust (abst.), 144
Caisson disease (decompression sickness) (abst.), 187
—aseptic necrosis of bone in (abst.), 309
Cancer
—detection activities in industry (Bulger & Fleming), 211
—of skin: epidemiology (abst.), 522
—pulmonary, in asbestos miners: epidemiological study (abst.), 187
—scrotal, in wax pressman (abst.), 619
Cancerigenesis, metal: cancerigenic effects of chromite ore roast (abst.), 185, 243
Carbon
—blacks: effect on carcinogenic compounds (abst.), 418
—dioxide: variations in coking plant (abst.), 466
—disulfide: maximum allowable and toxic concentrations (abst.), 472
—monoxide: physiologic effects of chronic exposure (abst.), 575
—monoxide intoxication: tolerable limits (abst.), 468
—tetrachloride: anuria due to intoxication with (abst.), 144
Carbon—continued
—tetrachloride: effect of poisoning with, on potassium, sodium, and water content of liver mitochondria (abst.), 665
Carcinogenesis
—dietary carcinogenicity: problem of testing (abst.), 464
—effects of petroleum asphalt (abst.), 664
—linear theory: critique (abst.), 66
Carcinoids, functioning: diagnosis and clinical management (abst.), 74
Carcinoma
—carcinomatous neuromyopathies (abst), 519
—effect of carcinogenic dosage and duration of exposure on skin-tumor induction in mice (abst.), 415
Central nervous system functions: effect of toxic compounds (abst.), 469
Cerium, radioactive, fluoride: bronchogenic carcinoma from (abst.), 254
Cerumen: new cerumenolytic agent (abst.), 574
Chemical industry: dermatitis in (Buckley & Norris), 333
Chemicals
—health aspects of production and marketing (abst.), 413
—industrial vs. therapeutic, in etiology of aplastic anemia (Fleming), 97
Chile: development and practice of occupational health (Oyanguren), 603
Chloracne: plastic planing (abst.), 132
Chloroform intoxication, chronic (abst.), 130
Chlorothiazide, and mercurial diuretics: relation between diuretic and antihypertensive effects (abst.), 662
Cigarettes: effects of condensates from smoke of, on human fetal lung in vitro (abst.), 359
Coal
—dust: tissue reactions in lungs after inhalation of dust containing 2% of quartz (abst.), 192
—mining: interrelated medical care plans in Southern Appalachian coal fields (Winebrenner), 497
Committees: nature and use (abst.), 567
Communication
—memo on (abst.), 354
—only seems simple (abst.), 72
Computers
—electronic: application of analog computer to analysis of distribution and excretion data (abst.), 420
—electronic: data processing and radiation exposure records (abst.), 419
Conformity: comments on (abst.), 190
Convalescence
—after surgery: introduction (Dohorn), 529
—surgical (editorial), 564
—surgical: current concepts (Moss), 541
—surgical: duration as indicated by insurance statistics (Saffeir), 535
Copper poisoning from vending machine (abst.), 193
Correspondence
—"Certification in Occupational Medicine" (Goldwater), 476
—gift subscriptions to Journal of Occupational Medicine (Warshaw), 300
—present position of government in occupational health (Kraul), 182
Counseling interview: crux of man's development (abst.), 190
Crotonaldehyde: toxicology (Henson), 461
Cyanosis, chemical: evaluation through improved techniques for hemoglobin analysis (abst.), 131
Cyclohexane, radioactive-carbon-labeled, and hexanol: metabolism (abst.), 527

D

DDT: prolonged intensive occupational exposure to (abst.), 186
Debricin (proteolytic enzyme) in surgical wounds: clinical experience (abst.), 246
Decaborane: toxicology (Roush), 47
Dentistry, industrial: expansion of fringe benefits and (abst.), 137

Dermatitis
—contact, from 4-tertiary butyl catechol in Thermo-Fax paper (abst.), 522
—contact, from hydrazine hydrochloride (abst.), 666
—contact, from neomycin (abst.), 196
—contact, from thermoplastic tape (abst.), 667
—contact: lichenoid eruptions following (abst.), 71
—contact: Philodendron as cause (abst.), 19.
—contact: poison ivy (abst.), 575
—contact: problems in atopic individual (abst.), 574
—hula-hoop (abst), 523
—in a chemical industry (Buckley & Norris), 333
—in industry (abst), 13
—lithographers' (abst.), 246
—Loeffler's syndrome in (abst.), 619
—occupational: prevention (abst.), 415
—shoe: diagnosis and management (abst.), 353
Dermatology: occupational skin problems: methods of evaluation for cutaneous hazards (Suskind), 119
Dermatomycosis: treatment with oral griseofulvin (abst.), 522
Dermatoses
—among office workers (abst.), 301
—changes in 10 commonest, in private practice (abst.), 301
Diabetes
—in industry (abst.), 358
—mellitus, unsuspected, in peripheral vascular disease (abst.), 183
—neuropathy as initial clinical manifestation (abst.), 183
Diborane: toxicology (Roush), 46
Diisocyanate
—toluene: industrial hygiene experiences with (abst.), 573
—toluene: microdetermination in atmosphere (abst.), 362
—toxicology (Wilson & Wilson), 449
—toxicology (abst.), 571
Disability
—evaluation: practical aspects (McGee), 387
—group insurance: abuse and control (Butler), 451
—permanent: management of trauma in relation to (McBride), 21
—what is it, and how is it measured (abst.), 135
Dupuytren's contracture (abst.), 69
Dust in cotton-spinning mills: safe levels (abst.), 465
Dysbarism: See also Caisson disease
—manifestation by anterior spinal artery syndrome (abst.), 252

E

Earning progression curves: technique for examining individual progress (abst.), 134
Ears
—can be protected (abst.), 35
—structure and function (Rosenwinkel et al.), 55
Eczema
—allergic: influence of preexposure to detergent, soap and acetone on reactions (abst.), 522
—multiple sensitivities (abst.), 619
—occupational, due to p-tertiary buty phenol in shoe adhesive (abst.), 666
—primary irritant and allergic reactions (abst.), 245
EDITORIALS
—accidental whole body irradiation, 474
—American Academy of Occupational Medicine, 125
—beginners' corner, 58
—convalescence after surgery, 564
—Council on Industrial Health, 179
—definition of a specialty, 58
—employment of handicapped (Warshaw), 656
—ergonomics, 237
EDITORIALS—continued
—first lady of industrial hygiene (Johnstone), 297
—free choice of physician, 404
—heart disease and employment, 178
—medical care and occupational medicine, 515
—new journal, 57
—plutonium toxicity (Ely), 296
—Robert T. Legge, 404
—Sickness absenteeism, 474
—silicosis, disease of autoimmunity, 346
—"toenail turmoil," 617
—worker placement: accentuate the positive, 617
—year end, 656
Electrocardiogram
—high voltage QRS complexes in absence of left ventricular hypertrophy (abst.), 416
—in neurocirculatory asthenia (abst.), 304
Electrolytes: synthetic polymers as tumor inhibitors (abst.), 527
Electronic computers: processing of medical data—surgical convalescence (Pell), 537
Emotional disorders: See under Mental health
Emotions: impact on production and safety (abst.), 71
Endicott Johnson Corporation: medical care plan (Klimow), 491
Epichlorhydrin
—toxicity of vapor (abst.), 305
Epoxy resins
—chemical injury of hemopoietic system induced by alkylating agents (abst.), 419
—curing: cutaneous effects associated with (abst.), 413
—irritating and sensitizing capacity (abst.), 70
Ergonomics (editorial), 237
Ethylene glycol: metabolism of C^{14}-labeled (abst.), 465
Executive health programs: do they meet their objectives? (abst.), 63
Extremities
—diagnosis of peripheral arterial emboli (abst.), 518
—upper: nerve injuries (abst.), 143, 357
Eyelids: styes, recurrent (abst.), 183

F

Face
—immediate management of severe maxillofacial injuries (abst.), 412
—treatment of wounds of (abst.), 307
Fallout, radioactive
—fetal irradiation and (abst.), 661
—protecting and cleaning hands contaminated by, under field conditions (abst.), 188
Fats, intravenous: clinical use in surgical patients (abst.), 571
Fatty Acids
—toxicology (Henson), 339
—tumor-promoting effect in skin of mice (abst.), 418
Femur: prostheses in treatment of fresh fracture of femoral neck (abst.), 69
Fingers: amputation levels in third finger (abst.), 413
Fluoride
—analysis (Cholak), 648
—deposition in soft tissues following skeletal saturation (abst.), 140
—gaseous: portable continuous analyzer for, in industrial environments (abst.), 362
—occurrence in air, food, and water (Cholak), 501
—sodium: encephalitis induced by intoxication in experimental animals (abst.), 418
Fluoroscopy: radiation safety evaluation in fluoroscopes (abst.), 142
Food-vending machines: developing ordinance and code for (abst.), 130
Foundries: siderosis in cleaning room employees (Hamlin), 79
Formaldehyde: toxicology (Henson), 459
Formic acid: toxicology (Henson), 343
Furfural intoxication: tolerable limits in rabbits (abst.), 467

G

Gastrointestinal tract: penetrating wounds of stomach, duodenum, and small intestine (abst.), 526
Gangrene: reversibility of pregangrene in severely ischemic limb (abst.), 142
Garment workers: severity of myocardial infarction in (Goldwater & Bronstein), 150
GB: See Isopropyl methylphosphonofluoridate
Glyoxal: toxicology (Henson), 461
Gout: diagnosis (abst.), 304
Government: position in occupational health (Miller), 27
Grafts and grafting
—circulation in normal tendon and healing grafts (abst.), 356
—dermal overgrafting of leg (abst.), 68, 137
—homografts as arterial replacements: failure (abst.), 665
—management of donor site (abst.), 665
—Marlec mesh, plastic, for replacing tissue defects (abst.), 196
—synthetic arterial substitutes: clinical use in 317 patients (abst.), 194
Granuloma pyogenicum: milkers' nodules of nose resembling (abst.), 196

H

Hair, scalp: peripilar keratin casts (abst.), 575
Hamilton, Dr. Alice: first lady of industrial hygiene (editorial, Johnstone), 297
Hand
—injuries in steel plant (Tauber), 255
—surgery: brachial plexus block for (Ditzler & Clifford), 363
Handicapped, employment of (guest editorial, Warshaw), 656
Health
—education: in industrial setting (abst.), 303
—insurance: medical care under plan of Greater New York (abst.), 570
—insurance, voluntary: problems in, and answers from Windsor (Ont.) experience (abst.), 198
—insurance: you're in business—big business (Markuson), 483
—needs of aged: how met in Colorado (abst.), 663
—plans, group: 20-year legal review (abst.), 662
—services, employee: business man looks at (abst.), 663
Hearing: See also Audiometry
—action of middle ear in normal cats (abst.), 569
—acuity: measurements of, among submariners (abst.), 668
—apparent reduction of loudness: repeat experiment (abst.), 668
—auditory screening: new concept (abst.), 135
—conservation in noise (abst.), 134
—conservation methods (abst.), 134
—dependence of temporary threshold shift on intensity and time (abst.), 409
—impairment: guide for evaluation, 167
—intensity and duration of noise exposure and temporary threshold shifts (abst.), 312
—loss and industrial noise, in controlled population (abst.), 74
—loss: importance of occupational and medical history in compensation cases (abst.), 189
—loss: noise and (Rosenwinkel et al.), 53, 396
—loss: noise and recognition of hazard (Rosenwinkel et al.), 225
—loss, temporary, at 4000cps as function of 3-minute exposure to noise of uniform spectrum level (abst.), 408
—loss: test of susceptibility to noise-induced loss (abst.), 135
—loss: what is zero loss? (abst.), 135

Hearing—continued
—relation between recovery temporary threshold shift and duration of exposure (abst.), 569
—sound-level surveys for conservation (abst.), 351
—temporary threshold evaluation produced by continuous and "impulsive" noises (abst.), 312
—temporary threshold shift and masking for noise of uniform spectrum level (abst.), 313
—temporary threshold shift as function of noise exposure level (abst.), 520
—temporary threshold shift from octave-band noise (abst.), 408
—temporary threshold shift resulting from noise exposure (abst.), 351, 408
—testing: intelligibility of known and unknown message sets (abst.), 519
—thresholds: effects of testing methods (abst.), 189
—thresholds, pure-tone: age and sex differences (abst.), 409
—Wisconsin State Fair survey (1954) (abst.), 134
Heart
—arrhythmia in chronic cor pulmonale (abst.), 247
—Korotkoff sounds: graphic recording (abst.), 662
—muscle: unrecognized myocardial infarction (abst.), 357
Heart disease
—and employment (editorial), 178
—and hypothyroidism (abst.), 133
—cardiac patient in industry (Coodley), 155
—effect of competitive industrial activity on severely disabled patients (abst.), 63
—fibrinolytic therapy of experimental coronary thrombi with alteration of evolution of myocardial infarction (abst.), 662
—magnitude of problem (Tauber), 158
—myocardial infarction: severity in garment workers (Goldwater & Bronstein), 150
—placement of patients with, in large refinery (abst.), 361
—work classification unit for patients with (Goldwater & Bronstein), 145
Heel: fractures of os calcis (abst.), 68
Hematoma, subdural, in elderly patient (abst.), 518
Hepatitis, cholangiolitic (abst.), 620
Hepatolenticular degeneration: clinical studies with penicillinamine in (abst.), 350
Hernia, internal strangulated, associated with trauma (abst.), 247
Hernioplasty
—inguinal and femoral (abst.), 194
—evaluation of basic concept (abst.), 14
Herniorrhaphy, inguinal: misuse of antibacterials (abst.), 623
Hexylene glycol excretion in man (abst.), 308
Hip fracture: life expectancy after (abst.), 192
Hoods, laboratory: evaluation of design changes and periodic performance (abst.), 64
Hospitals
—future role in medical care (abst.), 198
—physicians' private offices as (abst.), 361
—relation of costs to supply of beds (abst.), 518
Humerus: nonunion of epiphysis of lateral condyle (abst.), 137
Hydrocarbons
—aliphatic and alicyclic: toxicology (Henson), 105
—aromatic: excretion of 3,4-benzpyrene and other, in bile of rats after intravenous administration (abst.), 527
—halogenated: biochemical alterations of liver function by (abst.), 184
—halogenated: toxicity (abst.), 67
Hydrogen
—arseniuretted: poisoning in tank cleaners (abst.), 251
Hydrogen—continued
—cyanide: hazards, toxicology, prevention and management of poisoning (Wolfsie & Shaffer), 281
Hypertension, essential: prognosis (abst.), 415
Hyperventilation syndrome (abst.), 620
Hypoglycemic agents: toxicity (Bennison), 401

I

I^{131}: See Iodine, radioactive
Industrial health
—health of people who work (Keifer), 545
—in industrial and nonindustrial countries: comparative study (Forssman), 15
—labor health plans and industrial physician (Barnes), 477
—labor's goals (Sawyer), 479
Industrial Health Conference: American Industrial Hygiene Association not to participate after 1960, 655
Industrial hygiene
—Atomic Energy Commission fellowships, 11
—fifth conference: preview announcement, 166
—first lady of (editorial, Johnstone), 297
—aspects of nuclear technology (Wald), 113
—aspects of nuclear technology (Heller & Wald), 555
—aspects of nuclear technology: fundamentals of nuclear physics, health physics and radiation measurements (Wald), 289
—code of professional relationships of Academy of Medicine of Cincinnati, 100
—radiation as problem in (Dunham), 199
Industrial nursing: legal scope of practice (A.M.A. Committee on Industrial Nursing), 215
Industrial physicians: mutual relations of general practitioners to (abst.), 303
Industry
—cancer detection activities (Bulger & Fleming), 211
—cardiac patient in (Coodley), 155
—role in mental hygiene (Gordon), 277
—supervisor hasn't had a chance (abst.), 190
Inhalation: glass microspheres as tracers (abst.), 130
Insects, stinging: protective measures against (abst.), 414
Insurance
—hospital: Canada's national program (abst.), 136
—major medical expense (abst.), 244
Interviews, executive: pointers on asking questions (abst.), 355
Iodine, radioactive: I^{131} in human thyroids following Windscale reactor accident (abst.), 419
Iron: derivatives of protoporphyrin in intoxication with aromatic nitro and amine compounds (abst.), 471
Isocyanates: See also Diisocyanates
—organic: safe use and handling (abst.), 361
Isopropyl methylphosphonofluoridate: studies of chronic exposures of dogs to (abst.), 306

K

Kaiser Foundation health plan, and company medical program (Lewis), 494
Kanamycin: clinical experiences (abst.), 183
Ketones, aliphatic: toxicology (Henson), 607
Kidney, artificial: role in acute poisoning (abst.), 186
—injuries: management (abst.), 143
Knee: surgical treatment of injuries to ligaments of (abst.), 356
Kveim reaction: in sarcoidosis and tuberculosis (abst.), 568

L

Labor unions
—call shots on health service (abst.), 517
—health goals (Sawyer), 479
—health plans and industrial physician (Barnes), 477
Labor unions—continued
—welfare funds: impact on practice of medicine (abst.), 517
Ladies Garment Workers' health plan (abst.), 626
Larson Commission: See American Medical Association, Commission on Medical Care Plans
Lead
—common errors in diagnosis of plumbism (abst.), 618
—concentrations in blood of animals kept at various levels of printing plants (abst.), 469
—evaluation and control of exposure in powder metallurgy operations (abst.), 194
—inorganic: maximum limits for biological data in prevention of industrial intoxication (abst.), 468
—poisoning: analysis of organs for lead and observations on polarographic lead determinations (abst.), 138
Legge, Robert T.: 87th birthday (editorial), 404
Leisure: leisure society (abst.), 516
Ligaments: experimental investigations of healing (abst.), 665
Lithium
—distribution between serum and tissues (abst.), 305
—toxicity (abst.), 140
Liver
—function: azosulfamide (Neoprontosil) test in evaluation (abst.), 620
—radiation and leukemia (abst.), 420
—wounds of (abst.), 307
Los Alamos Scientific Laboratory: nuclear accidents, 424, 425
Lungs
—diseases among sisal workers (abst.), 667
—farmer's lung (abst.), 185
—fibrosis in aluminum worker (abst.), 618
Lungs: pathology in nickel workers (abst.), 186
Lupus erythematosus, systemic
—pleuritis as early diagnostic sign (abst.), 132
—precipitation test (abst.), 304

M

Magnesium, radioactive: gastrointestinal absorption in rabbits (abst.), 359
Malathion: potentiation of toxicity by triorthotolyl phosphate (abst.), 358
Maleic acid: toxicology (Henson), 345
Management
—development: new look at (abst.), 72
—discovers psychiatry (abst.), 355
—executive appraisal (abst.), 134
—executive development (abst.), 411
—executive personality (abst.), 313, 335
—executive who was always fair (abst.), 313
—in 1980's (abst.), 252
—key factors in effective foreman behavior (abst.), 314
—managerial decision-making (abst.), 190
—managerial mind (abst.), 314
—novelists' pictures of (abst.), 335
—personnel: dynamic aspects of personnel manager's role (abst.), 190
—physician as advisor to (abst.), 197
—rarest man in business (abst.), 516
Manganese minerals: factors modifying toxicity (abst.), 466
Maximum allowable concentrations
—aspects of safety limits in industry (abst.), 468
—biological values: determinations (abst.), 472
—experimental methods used as basis for determination (abst.), 465
—importance of, for harmful industrial compounds and their determinations (abst.), 469
—importance of individual sensitivity in evaluations of tolerable limits in industry (abst.), 471

Maximum allowable concentrations—cont'd
—in German Democratic Republic (abst.), 469
—in industry: concepts in Italy (abst.), 467
—international symposium, 463
—methods used in establishment (abst.), 472
—new industrial compounds: methods used in establishment (abst.), 471
—of "inert" substances (abst.), 469
—present concepts and definitions in various countries (abst.), 464
—requirements of analytical methods (abst.), 469
—so-called maximum biological allowable limits (abst.), 467
—tolerable limits and safe limits (abst.), 467
—tolerable limits in industry (abst.), 471
Medical care
—and occupational medicine, 515
—elevation of standards (abst.), 136
—new horizons for (abst.), 197
—plans: Endicott Johnson Corporation (Klimow), 491
—plans: interrelated in Southern Appalachian coal fields (Winebrenner), 497
—plans: of Kaiser Foundation, and company medical program (abst.), 494
—plans: Windsor (Ont.) Medical Services, Inc. (Robson), 486
—role of federal government in financing for aged (abst.), 360
Medical practice
—in industrial society (abst.), 302
—malpractice: professional liability (Holman), 94
—sociologic trends (abst.), 136
—third party in medicine (abst.), 410
Medical service, preventive: role of government and community (abst.), 626
Melanoma: sex and survival (abst.), 414
Meningitis, leptospiral (abst.), 620
Mental health
—bituminous coal country—psychiatric frontier (abst.), 570
—emotional disorders: prevention by family physician (abst.), 625
—emotional disorders: detection and management by industrial physician (Hipps), 329
—psychosomatic problems in rapidly growing suburb (abst.), 624
Mental hygiene: role of industry in (Gordon), 277
Mental illness, reversible and irreversible (abst.), 660
Mercury
—mercuric chloride: protection by d-penicillamine against lethal effects of (abst.), 66
—mercuric chloride and methyl mercury dicyandiamide: metabolism (abst.), 665
—organic (abst.), 308
—poisoning: effect of calcium disodium versenate (abst.), 193
—poisoning: N-acetyl-dl-penicillamine, new oral protective agent against lethal effects (abst.), 575
Meteorology: tool of management (abst.), 621
Methyl
—butyl ketone: toxicology (Henson), 612
—ethyl ketone: toxicology (Henson), 611
—propyl ketone: toxicology (Henson), 611
Meticortelone: See Prednisolone
Mg^{28}: See Magnesium, radioactive
Microwaves: effect of 24,000 megacycle radiation on experimental animals (Deichmann et al.), 369
Mitral stenosis: electrocardiographic repsonse to exercise in patients with (abst.), 416
Mononucleosis, infectious: interpretation of hematologic and serologic data in diagnosis (abst.), 248
Myocardial infarction: See under Heart disease

N

Nails (anatomic)
—diseases (abst.), 131
—onycholysis in hyperthyroidism (abst.), 248
Naphthalene: glutathione metabolism in erythrocytes in anemia induced by (abst.), 350
Navy, U.S.: occupational medicine in (Shaw & Hutchinson), 391
Nerve block, regional, simple, for surgery of hand and arm (abst.), 307
New York University Post Graduate Medical School, Institute of Industrial Medicine: course on radiation hygiene measurements, 118
Nickel
—poisoning: Dithiocarb new therapeutic agent for persons exposed to nickel carbonyl (abst.), 572
—poisoning: carcinogenesis in rats exposed to nickel carbonyl (abst.), 625
—poisoning: ineffectiveness of edathamil calcium-disodium (abst.), 184
—sensitivity to: rise in incidence (abst.), 414
Nitric acid: toxicity of red fuming, vapor mixture (abst.), 67
Nitrogen oxides: occurrence, toxicity, hazard (abst.), 521
Nitro-olefins: acute effects on experimental animals (abst.), 185
N,N-diethyl-m-toluamide: pharmacologic and toxicologic studies (abst.), 243, 305
Noise
—airport and jet (abst.), 249
—and hearing loss (Rosenwinkel et al.), 53, 396
—and hearing loss: recognition of hazard (Rosenwinkel et al.), 225
—and man (abst.), 75
—characteristics for Boeing 707 (abst.), 249
—characteristics of jet ground operations (abst.), 351
—effect on intellectual task (abst.), 312
—effects on man (abst.), 135
—foundry (abst.), 249
—industrial: acoustical factors in jet airport design (abst.), 569
—industrial: Electra acoustical program (abst.), 249
—industrial: field and laboratory examples of control (abst.), 249
—industrial: making compressor stations quiet enough to live with (abst.), 569
—industrial: problems and solutions (abst.), 249
—is it a health problem? (abst.), 189
—masking, remote: intensive determinants (abst.), 312
—relation of hearing loss to exposure (abst.), 75
—suppressors for jet engines (abst.), 249
—white: halving and doubling loudness of (abst.), 668
Nuclear energy
—labor relation aspects (abst.), 525
—nuclear weapon explosion and its effect on treatment of soft tissue wounds (abst.), 195
Nuclear technology
—fundamentals of nuclear physics, health physics and radiation measurements (Wald), 289
—health aspects (abst.), 573
—industrial medical aspects of (Wald), 113, 555

O

Oak Ridge, Tenn., reactor criticality accident, 425
Occupational health: See also Industrial Health; Industrial Hygiene; Occupational Medicine
—development and practice in Chile (Oyanguren), 603
—government in (Miller), 27
—great hiatus (abst.), 570
Occupational health—continued
—should program be included in local health department (abst.), 409
Occupational medicine
—certification: background and policies (Kehoe), 262
—certification: nature and objectives of the specialty (Sterner), 264
—certification: qualifications of certified specialist (Kammer), 267
—compensations to physician in (abst.), 244
—contribution to permissible concentrations in (abst.), 468
—in U. S. Navy (Shaw & Hutchinson), 391
—medical care and, 515
—practice of clinical toxicology in (Johnstone), 12
—whither and how (Kehoe), 1
Of time and the worker (abst.), 411
Organization: what makes it healthy? (abst.), 191
Oxalic acid: toxicology (Henson), 344
Oxygen
—consumption: effect of restraint on, in cold-exposed guinea pig (abst.), 306
—erythropoietic factor in hypoxic patients with emphysema without secondary polycythemia (abst.), 620

P

Pancreatitis, acute (abst.), 248
Paracentesis, diagnostic (abst.), 195
Paraldehyde: toxicology (Henson), 461
Parathion residues as cause of poisoning in crop workers (abst.), 73
Particulates
—finding ultra-fine particles with new detector (abst.), 621
—submicromic: deposition in respiratory tract (abst.), 574
—value of phase microscopy for examination of matter collected on membrane filters (abst.), 621
Patella
—in degenerative disease (abst.), 138
Penicillinase
—anaphylactic type reaction attributed to (abst.), 301
—severe reactions in therapy (abst.), 245
Pentaborane: toxicology (Roush), 47
Pentachlorophenol: hazards associated with use of (abst.), 524
Personnel
—administration: future of (abst.), 72
—relations: good with people (abst.), 252
—relations: internal harmony (abst.), 660
Phenothiazine: newer agents in treatment of nervous disorders (abst.), 567
Phenylalkanes: biochemorphology of phenylalkenes and (abst.), 418
Pheochromocytoma: method for chemical of urinary catechol amines in diagnosis (abst.), 304
Phlebitis: postphlebitic syndrome: ancillary care (abst.), 526
Phlebography: of femoral head as method for predicting viability (abst.), 138
Phosphates
—organic: histochemical proof of poisoning (abst.), 416
—organic: subacute toxicity to dogs (abst.), 243
—organic, insecticidal: potentiation of toxicity (abst.), 184
—organic, insecticidal: skin manifestations of poisoning (abst.), 71
—superphosphate: value of biochemical tests in evaluating toxicity (abst.), 471
Phosphine: toxicity (abst.), 185
Physical ability: clues in evaluation (Hanman), 595
Plutonium
—decontamination tests on surgeon's glove (abst.), 573
—deposition in human skin: autoradiographic analysis (abst.), 254

Plutonium—continued
—internally deposited: determination of injury from (Norwood), 269
—poisoning: chelating agents for treatment (abst.), 623
—toxicity (editorial, Ely), 296
—use of gamma-ray spectrometer for inspecting wounds contaminated by (abst.), 189
Pneumoconiosis
—pathogenesis: newer concepts (Sander), 7
—talc (abst.), 416
Poliomyelitis: penicillinase-proved allergy to penicillin in vaccine (abst.), 301
Polyoxyethylene stearate: safety for use in foods (abst.), 576
Porphyria, acute intermittent, with respiratory paralysis (abst.), 303
Prednisolone in epicondylitis (abst.), 357
Professional liability: results of national survey (Holman), 96
Professional men: six pitfalls for (abst.), 516
Proteases, buccally administered: physiological and clinical effects (abst.), 624
Psychiatry
—industrial (abst.), 354
—industrial, as preventive psychiatry (abst.), 313
—psychiatric aspects of adult patient in general hospital (abst.), 411
Psychosomatic medicine: current theoretical concepts (abst.), 517
Pu^{239}: See Plutonium

R

Radiation: See also Microwaves; individual radioactive elements and isotopes by name, as Plutonium; Radiography
—current status of internal dose problem (abst.), 311
—due to fission products in biological material (abst.), 419
—environmental: impact on total health (abst.), 352
—exposure as reasonable calculated risk (abst.), 311
—exposures of persons at 60-inch cyclotron (abst.), 622
—Geneva counter: liquid scintillation counter for men and mesons (abst.), 188
—hazards: primer for physicians (abst.), 524
—health hazards of laundering contaminated protective clothing (abst.), 66
—industrial medical problem (Dunham), 199
—injury, accidental: diagnosis and management (Thoma & Wald), 421
—injury claims: evidentiary problems (abst.), 623
—ionizing: biological effects (abst.), 353
—ionizing: delayed effects in man (abst.), 188
—ionizing: structural aspects of lymphocytes and monocytes in relation to clinical condition of persons exposed to (abst.), 525
—maximum permissible dietary contamination after accidental release of material from nuclear reactor (abst.), 622
—medical: evaluation of somatic and genetic hazards (abst.), 65
—organic and inorganic urinary excretion values in normal and in irradiated subjects (abst.), 310
—penetrating: acute clinical effects (abst.), 65
—primer on hazards for physicians (abst.), 358
—protection laws and codes (abst.), 573
—protection—standards and laws (Fleckenstein), 643
—radioactivity and human skeleton (abst.), 141
—ultra-high-frequency: cataracts and (abst.), 139
Radiation—continued
—whole-body irradiation, accidental, 474
—whole-body irradiation and bone marrow transplantation (abst.), 253
Radioisotopes: See also individual isotopes
—autoradiographic studies on connective tissue formed around embedded plastics (abst.), 527
—incorporated: unusual localization in animal body and their radiobiological aspects (abst.), 661
Radiography: radiation reduction by combined copper and aluminum filtration (abst.), 623
Radiology
—clinical radiologist and problems of radiation hazards (abst.), 524
—evaluation of exposure in (abst.), 187
—radiation doses in diagnostic procedures (abst.), 141
—resurvey of cement workers (abst.), 73
Radium
—limitations of urinary radium as measure of body load (abst.), 253
—poisoning: where are patients? (abst.), 65
Railroad industry: lost time cases: comparison with steel mills (Halen), 203
Rehabilitation
—industrial physician's appraisal (Lauer), 589
—motivation of patient (abst.), 72
Retirement: preparation for (Shillito), 382
Rheumatic fever: in adult: criteria and implications (abst.), 415

S

Safety evaluation: procedures and methods (abst.), 64
Sarcoma: induction in rats by iron-dextran complex (abst.), 418
Scars: problem of painful scar (abst.), 195
Schizophrenia: biochemical concepts (abst.), 133
Scurvy: occupational disease (McCord), 315
Selenium: effect on vitamin-E-deficient rats (abst.), 306
Shoulder
—arm syndrome: basic concepts (abst.), 525
—painful: methods and results of treatment (abst.), 68
—stiff, iatrogenic (abst.), 306
Siderosis: observations on foundry cleaning room employees (Hamlin), 79
Silica
—amorphous: tissue reactions to quartz and (abst.), 359
—free dust concentrations in brick manufacturing plants (abst.), 53
Silicosis
—disease of autoimmunity (editorial), 346
—experimental: morphogenesis of silicotic nodule (abst.), 139
—immunological approach (Vigliani & Pernis), 319
—of ocher workers (abst.), 144
Silo fillers' disease (abst.), 72
Silo filling: delayed death by gassing in silo containing green forage (abst.), 618
Skin
—carcinogenesis: licking as factor affecting dosage (abst.), 305
—carcinoma: experimental analysis of "hair cycle effect" in mouse (abst.), 305
—defenses: anatomical, physiological, and biochemical factors (Suskind), 39
—disease: multiple factors in causation (abst.), 666
—disease, occupational: causes (Suskind), 42
—disease: pathologic patterns and reaction sites (Suskind), 42
—eruptions of workers in uranium-processing plant (abst.), 414
—problems: occupational (Suskind), 39
—problems, occupational: case study and diagnostic appraisal (Suskind), 230
—sensitivity to adhesive tapes (abst.), 667
—specific metabolic processes (abst.), 354
—surface biology (Suskind), 40
—suture marks (abst.), 246
Skin—continued
—traumatic calcinosis (abst.), 132
Skin tests: for anti-inflammatory activity (abst.), 522
Smallpox vaccination: acute pericarditis following (abst.), 132
Soaps and detergents: effect of washing with, on lipid level of skin of hands (abst.), 619
Socialized medicine 10 years old: lessons from England's experiment (abst.), 517
Sodium chloride: experimental epidemiology of chronic toxicity and protective effect of potassium chloride (abst.), 184
Sound: frequency response of human ear (Rosenwinkel et al.), 56
Space flight: See Aviation medicine
Speech
—communication, direct: limits in noise (abst.), 520
—vowels: relative intensities of sounds at various anatomic locations of head and neck during phonation (abst.), 519
Spondylitis
—ankylosing: osteotomy of cervical spine (abst.), 137
—rheumatoid: manifestations and management (abst.), 74
Staphylococci: gamma-globulin therapy of chronic dermatoses due to (abst.), 353
Steel plants
—hand injuries in (Tauber), 255
—lost time cases: comparison with railroad industry (Halen), 203
Steroids
—status of therapy in rheumatic disorders (abst.), 518
—therapy in surgical patients (abst.), 624
Stomatitis, aphthous, with herpes labialis and related conditions (abst.), 619
Stress: facing up to stress of modern life (abst.), 567
Strokes, spontaneous, in young (abst.), 303
Strontium, radioactive
—deposition through Oct., 1958 (abst.), 661
—metabolism in beagle dogs (abst.), 140
—relative hazards of Ra^{226} and (abst.), 420
Submarine medicine: on Nautilus and Seawolf (abst.), 352
Suicide: social and legal aspects (abst.), 660
Sulfur
—dioxide: measurement of pulmonary resistance and compliance with concurrent tissue radioactive sulfur determinations in dogs inhaling (abst.), 359
—organic compounds: acute toxicity of some aliphatic and aromatic thiols (abst.), 67
Sumac: cross-sensitization in diverse members of sumac family (abst.), 245
Surgery
—convalescence after: introduction (Dohan), 529
—duration of convalescence as indicated by insurance statistics (Saffeir), 535
—on choosing a surgeon (abst.), 410
—return to work after (Fleming), 531
Sweet orange, oil of: possible role in carcinogenesis (abst.), 576
Syncope: in population of healthy young adults (abst.), 247
Syphilis: false-positive reactions, biologic: laboratory studies (abst.), 301

T

Tannic acid: hepatocarcinogenicity (abst.), 626
Telangiectasia, hemorrhagic, hereditary: vascular lesion of (abst.), 354
Temperature, environmental: effects on acute toxicity of 58 compounds in rats (abst.), 576
Tendons, flexor, severed (abst.), 412
Tetanus
—evaluation of treatment (abst.), 68
—permanence of immunization against (abst.), 194
—preventable disease (abst.), 191
Thallium
—partial alopecia due to (abst.), 666
—poisoning, criminal (abst.), 417

Thorium
—therapy with chelating agents (abst.), 252
—determination in urine (abst.), 253
Thyroid: digital clubbing and exophthalmos in disorders of (abst.), 568
Tin
—butyl: lesions of skin of process workers caused by contact with (abst.), 71
—butyl [bis (tri-n-butyl) oxide]: toxicology (abst.), 66
—diethyl: lesions of central nervous system secondary to ingestion of (abst.), 576
Toxicity
—evaluation of methods of assessing (abst.), 359
—of bis (2-ethyl-hexyl) hydrogen phosphite (abst.), 184
—of hypoglycemic agents (Bennison), 401
Toxicology
—clinical: practice in occupational medicine (Johnstone), 12
—evaluation of data (Fassett), 169
—method for reporting information (abst.), 243
Toxic substances
—evaluation of exposure to, in industry (abst.), 468
—maximum allowable concentrations: basic concepts (abst.), 473
—small doses: individual sensibility of organism and physical labor as factors in poisoning with (abst.), 472
—small doses: methods for determining influence on man (abst.), 472
Tranquilizers: allergic reactions to (abst.), 74
Transaminase
—clinical significance of serum levels (abst.), 568
—in serum and liver, correlated with liver cell necrosis in needle aspiration biopsies (abst.), 523
Transfusions, multiple: dangers (abst.), 623
Trauma
—management in aged (abst.), 147
—management in relation to permanent disability (McBride), 21
—metabolism of (abst.), 307
—postoperative sodium retention (abst.), 356
Trichloroethane: metabolism in rat (abst.), 419
Trichloroethylene
—physiological effects on conditioned responses in rat (abst.), 466
Trichloroethylene—continued
—toxicity (Williams), 549
—toxicity of 1,1,1-trichloroethylene (abst.), 138
Tricresylphosphate: toxicity (abst.), 527
Trigger finger: treatment by subcutaneous method (abst.), 69
Trimethylbenzine: toxicology (abst.), 306
Troubled employee (abst.), 245
Tuberculopneumoconiosis: experimental (abst.), 527
Tuberculosis, pulmonary, associated with carcinoma of lung (abst.), 357
Tumors, bone-forming: relation to skeletal growth (abst.), 138
Tunneling operations: hygienic aspects (abst.), 251
Tween 60: tumors induced with: biological behavior (abst.), 527

U

Ulcer, gastroduodenal: chronic pulmonary disease and (abst.), 620
United we stand—divided we fall (abst.), 410
University of Cincinnati College of Medicine, Institute of Industrial Health: graduate courses, 52
Uranium
—fabrication: industrial hygiene of (abst.), 521
—natural: maximal permissible amounts in body, air, and drinking water (abst.), 352
Urine: value of measuring mercury and cadmium concentrations in (abst.), 468

V

Vanadium
—effect on serum cholesterol levels in man (abst.), 523
—signs and symptoms of occupational exposure to (abst.), 572
—dynamic apparatus for preparing mixtures of air and, of known concentration (abst.), 250
—toxicity: investigation (abst.), 465
Varnishers, spray: clinical investigation (abst.), 309
Vinca, Yugoslavia, reactor accident, 425
Vision: effect of breathing 100% oxygen on visual fields and acuity (abst.), 251
Vitamin B_{12}: tobacco amblyopia as clinical manifestation (abst.), 73

W

Welding
—arc: investigation of exposure of welders (abst.), 574
—hygiene of, in U. S. Naval shipyards (abst.), 368
—inert-gas tungsten arc: health hazards in shop (abst.), 130
Windsor, Ontario, Medical Services, Inc. (Robson), 486
Work
—evaluation clinic: operation in university medical center (Felton), 577
—technique for assessing adjustment (abst.), 71
Wounds
—debridement (abst.), 571
—effect of antibacterial agents on clean wounds (abst.), 356
—evaluation of surgical suture material (abst.), 413
—of liver (abst.), 571
Wrist: surgical anatomy in lacerations of hand and (abst.), 191

X

X-rays
—Armadillo protective clothing (abst.), 142
—carcinoma of thyroid in children following (abst.), 310
—dental: radiation hazards associated with (abst.), 525
—diagnostic and therapeutic in urban population (abst.), 420
—diagnostic procedures: gonadal exposure dose (abst.), 141
—late effects on life span, leukemia, and incidence of arteriolosclerosis in mice (abst.), 572
—modification of lethality by autologous marrow infusion in dogs (abst.), 188
—radiation exposure from dental units (abst.), 311
—responses of developing fetal nervous system to (abst.), 187

Y

Yale University, Summer school of alcohol studies: announcement, 182

Z

Zinc: toxicity in rat, and interrelation with copper (abst.), 526

AUTHORS INDEX

Amdur, M. L., 627; biog. 23a (D)
Barnes, A., 477; biog. 21a (S)
Bennison, R. E., 401; biog. 17a (Jl)
Bronstein, L. H., 145
Buckley, W. R., 333: biog. 28a (Je)
Bulger, T. J., 211
Butler, R. W., 451; biog. 19a (Ag)
Carpenter, C. P., 634; biog. 23a (D)
Cholak, J., 501; biog. 23a (S)
Clifford, R. H., 363: biog. 15a (Jl)
Coodley, E. L., 155; biog. 21a (M)
Deichmann, W. B., 369; biog. 15a (Jl)
Ditzler, J. W., 363; biog. 15a (Jl)
Doerfler, L. G., 53, 225, 396
Dohan, F. C., 529; biog. 25a (O)
Dunham, C. L., 199; biog. 19a (Ap)
Ely, T. S., 296
Fassett, D. W., 169; biog. 22a (Mar)
Felton, J. S., 577; biog. 23a (N)
Fleckenstein, D. C., 643; biog. 24a (D)
Fleming, A. J., 97, 211, 531; biog. 17a (F)
Forssman, S. V., 15; biog. 76 (Jan)
Goldwater, L. J., 145; biog. 21a (Mar)
Gordon, G., 277; biog. 16a (May)
Halen, R. J., 203; biog. 19a (Ap)
Hamlin, L. E., 79; biog. 17a (F)
Hanman, B., 595; biog. 24a (N)
Hardy, H. L., 215; biog. 20a (Ap)
Heller, M. B., 555; biog. 27a (O)
Henson, E. V., 105, 339, 457, 607; biog. 18a (F)
Hipps, J. G., 329; biog. 27a (Je)
Holman, E. J., 94; biog. 17a (F)
Hutchinson, G. D., 391; biog. 17a (Jl)
Johnstone, R. T., 12, 297; biog. 77
Kammer, A. G., 267; biog. 15a (May)
Kehoe, R. A., 1, 262; biog. 76 (Jan)
Kendall, C. E., 174; biog. 22a (Mar)
Keplinger, M., 369
Kiefer, N. C., 545; biog. 26a (O)
Klimow, N. I., 491; biog. 22a (S)
Lampe, K. F., 369
Lauer, D. J., 589; biog. 23a (N)
Lewis, H. A., 494; biog. 22a (S)
McBride, E. D., 21; biog. 77 (Jan)
McCord, C. P., 315; biog. 27a (Je)
McGee, L. C., 387; biog. 16a (Jl)
Markuson, R. E., 483; biog. 21a (S)
Miller, S. E., 27; biog. 77 (Jan)
Moss, N. H., 541; biog. 26a (O)
Nair, J. H., III, 634; biog. 24a (D)
Norris, J. L., 333; biog. 28a (Je)
Norwood, W. D., 269; biog. 15a (May)
O'Connor, R. B., 163; biog. 22a (Mar)
Oyanguren, H., 603; biog. 25a (N)
Palm, P. E., 634; biog. 24a (D)
Pell, S., 537; biog. 25a (O)
Pernis, B., 319
Pozzani, U. C., 634; biog. 23a (D)
Price, L., 150; biog. 21a (Mar)
Roberts, B., 101; biog. 17a (F)
Robson, R. B., 486; biog. 22a (S)
Rosenwinkel, N. E., 53, 225, 396; biog. 20a (Ap)
Roush, G., Jr., 46; biog. 78 (Jan)
Saffeir, H. J., 535; biog. 25a (O)
Sander, O. A., 7; biog. 76 (Jan)
Sawyer, W. A., 479; biog. 21a (S)
Schilling, R. S. F., 33; biog.77 (Jan)
Shaffer, C. B., 281; biog. 16a (May)
Shaw, C. C., 391; biog. 16a (Jl)
Shillito, F. H., 382; biog. 15a (Jl)
Stephens, F. H., Jr., 369
Sterner, J. H., 264; biog. 15a (May)
Stewart, K. C., 53, 225, 396
Suskind, R. R., 39, 119, 230; biog. 78 (Jan)
Tauber, J. B., 158, 255; biog. 21a (Mar)
Tepper, L. B., 215; biog. 20a (Ap)
Thoma, G. E., Jr., 421; biog. 19a (Ag)
Vigliani, E. C., 319; biog. 27a (Je)
Wald, N., 113, 289, 421, 555; biog. 18a (F)
Weil, C. S., 634; biog. 24a (D)
White, S. C., 207; biog. 19a (Ap)
Williams, J. W., 549; biog. 27a (O)
Wilson, C. L., 207; biog. 19a (Ap)
Wilson, G. L., 448; biog. 19a (Ag)
Wilson, R. H., 448; biog. 19a (Ag)
Winebrenner, J. D., 497; biog. 22a (S)
Wolfsie, J. H., 281; biog. 16a (May)

GENERAL SECTION INDEX

A

Aero Medical Association: 30th annual meeting, 23a (Ap)
American Academy of Occupational Medicine
—11th annual meeting, 16a (Jan)
—11th annual meeting: awards and officers elected, 22a (Ap)
American Academy of Ophthalmology and Otolaryngology: Sub-committee on Noise: sound film, 23a (Ap)
American Association of Industrial Nurses: 17th annual business meeting: president elected, 21a (Jl)
American Board of Preventive Medicine: examinations in occupational medicine, 14a (Ap)
American College of Chest Physicians: silver anniversary meeting, 20a (Fe)
American Heart Association: sound film, "Back on the Job," 23a (Ap)
American Medical Association
—Commission on Medical Care Plans: report, 15a (Jan)
—Committee on Medical Aspects of Automobile Injuries and Deaths: medical guide for determination of fitness to drive an automobile, 20a (May)
American Public Health Association: Occupational Health Section: annual symposium, 30a (O)
Appointments and elections
—Allen, H. B., 16a (Jan)
—Allen, Harold Y., 29a (Je)
—Armen, Robert N., 24a (S)
—Barden, Frank W., 31a (D)
—Baylor, C. H., 19a (Fe)
—Bond, Marcus B., 19a (Jl)
—Brooks, Bert W., 24a (S)
—Burbank, Bernerd H., 20a (Jl)
—Chittum, J. R., 22a (Ag)
—Chivers, Joseph H., 17a (Jan)
—Collings, Gilbeart H., Jr., 29a (Je)
—Collins, Ralph T., 28a (N)
—Davison, Thomas H., 30a (D)
—Everts, Glenn S., 25a (S)
—Fisher, Frank L., 17a (May)
—Flinn, Robert H., 24a (Mar)
—Franck, G. H., 30a (D)
—Fransway, R. L., 27a (N)
—Gardiner, H. Glenn, 18a (Jan)
—Hamblin, Donald O., 24a (S)
—Hollis, Lynn, E., 21a (Ap)
—Klein, Irving, 19a (Jl)
—Lamb, Harry, 17a (May)
—Leder, Frank E., 21a (Jl)
—Legge, Christopher, 17a (Jan)
—Lewis, Charles E., 17a (May)
—Long, N. Gillmor, 25a (S)
—Lyon, Harold T., 21a (Ag)
—McClellan, William A., 22a (Ap)
—Mac Iver, John, 23a (Mar)
—Macon, William L., 25a (S)
—Markuson, Kenneth E., 17a (Jan)
—Norma, I. L. V., 22a (Ap)
—Peffer, John R., 19a (Fe)
—Peterson, G. H., 27a (N)
—Puleo, A. M., 28a (N)
—Ruffin, Joseph B., 27a (N)
—Salomon, James L., 30a (D)
—Schrenk, H. H., 15a (Jan)
—Sessions, Howard K., 27a (N)
—Sisk, Wilfred N., 21a (Ap); 27a (N)
—Smead, H. H., 16a (Jan)
—Smith, Austin, 21a (Ap)
—Steiner, S. D., 20a (Fe)
—Tauber, Joseph B., 21a (Ap)
—Troxel, John C., 30a (Je)
—Udel, Melvin M., 23a (Mar)
—Waggoner, James N., 21a (Ag)
—Welsh, John J., 21a (Ag)
—Wilkins, George F., 15a (Jan)
—Williams, Theodore L., 21a (Ag)
—Yant, William P., 15a (Jan)
Armco Steel Corporation: program for rehabilitation of alcoholics, 23a (Mar)
Awards and citations
—Fulton, William J., 24a (Je)
—Holmblad, Edward C., 7a (May)
—Kaiser, Henry J., Jr., 22a (Je)
—Kimberly-Clark Corporation, Fullerton, Calif., 13a (Fe)
—Maui Pineapple Company, 31a (D)
—McGee, Lemuel C., 20a (Je)
—Robertson, Logan T., 24a (Je)
—Rusk, Howard A., 19a (Fe)
—Scovill Manufacturing Company, Waterbury, Conn., 13a (Fe)
—Sterner, James H., 22a (Ap)

C

Canadian Medical Association, Committee on Occupational Medicine, 17a (Jan)
Central States Society of Industrial Medicine and Surgery
—officers elected, 30a (Je)
—spring meeting: announcement, 18a (May)
—winter meeting: announcement, 29a (N)
Colombian Ministry of Public Health: occupational health seminar, 31a (O)

D

Deaths
—Burnell, Max Ronald, 29a (O)
—Gehrmann, George H., 29a (O)
—Remington, A. C., 21a (Jl)
—Mock, Harry E., 22a (Jl); 23a (Ag)
—Watson, Cassius H., 22a (Jl); 23a (Ag)

G

Greater New York Association of Industrial Nurses, Inc.: annual safety conference, 24a (Mar)

I

Industrial Health Conference: organization and planning committees, 14a (Ap)
Industrial Hygiene Foundation: new officers, 15a (Jan)
Industrial Medical Association
—annual banquet, 7a (May)
—annual business meeting: report, 12a (Je)
—Assistant Managing Director: Rita Kirtley Packer, 25a (Je)
—Board of Director's meeting, Oct. 17, 1959: abstract of minutes, 25a (D)
—Committee on Chest Diseases and Committee on Radiation: joint report on chest x-ray procedures, 5a (Jl)
—District Counselors in Puerto Rico and Cuba, 29a (N)
—exhibit manager: William J. Burns, 25a (Je)
—44th annual meeting: preliminary program, 13a (Jan)
—Managing Director: Clark D. Bridges, 25a (Je)
—officers elected, 8a (May)
—proposed changes in by-laws, 17a (Mar)
—revised by-laws (April 29, 1959), 16a (S)
Industrial Medical Association of Philadelphia
—Hand Injuries in Industry, 22a (Fe)
—joint meeting with Industrial Nurses Association of Philadelphia, 23a (Ap)
Industrial Medical Association of Pittsburgh, 27a (S)
—officers elected, 28a (N)
—spring meeting: announcement, 18a (May)
Industrial Medical Conference of Ontario and Quebec, 27a (S)
International Conference on the Human Sciences and Their Application in Industry, 20a (Fe)
International Ergonomics Association, 25a (S)
International Symposium on Maximum Allowable Concentrations of Toxic Substances in Industry, 22a (Fe)

L

Lake Logan Conference, 5th annual, 20a (Jl)
Legge, Robert T.: history of Western Industrial Medical Association, 15a (Jan)

M

Menninger Foundation: Maintaining Emotional Health, 4th annual seminar, 22a (Ap)
Michigan Industrial Medical Association: officers elected, 19a (May)
Minnesota Academy of Occupational Medicine and Surgery, 13a (Jan)
—joint meeting with Minnesota League for Industrial Nursing, 20a (May)
—officers elected, 22a (Ag)
Minnesota Heart Association
—Cardiac-in-Industry conference, 30a (Je)

N

National Health Council
—National Health Forum, 20a (Fe); 29a (N)
National University of Bogota, Colombia: occupational health seminar, 31a (Je)
New Jersey Industrial Health Conference, 28a (N)
New York State Association of Industrial Nurses: 87th annual health conference: announcement, 30a (O)
New York State Society of Industrial Medicine, 27a (S)
Northwest Association of Occupational Medicine, 25a (D)
—annual meeting: announcement, 25a (S)
—occupational health conference, 25a (Mar)

O

Occupational Health Institute
—certificate of health maintenance, 13a (Fe)
—certificate of health maintenance, 31a (D)
—minimal standards for accreditation, 13a (Fe)

P

Pacific Northwest Industrial Health Conference, 6th annual: announcement, 26a (S)

R

Retirements
—Burnell, Max R., 20a (Fe)
—Foulger, John H., 22a (Ag)
—Holmblad, Edward C., 7a (May)
—Newquist, Melvin N., 19a (Fe)
Rocky Mountain Academy of Industrial Medicine, 29a (O)

S

South African Council for Scientific and Industrial Research, Pneumoconiosis Research Unit: conference on pneumoconiosis, 18a (Jan)

T

Territorial Association of Plantation Physicians: annual meeting: officers elected, 26a (Mar)
Texas Industrial Medical Association
—annual meeting, 21a (Fe)
—officers and directors elected, 31a (Je)

U

United States Air Force: sound film, "Air Force industrial medicine in action," 29a (N)
University of Texas: 5th occupational health conference, 24a (Ap)
University of Chicago School of Medicine: Section on Nuclear Medicine, 24a (Mar)

W

Western Industrial Medicine Association, 15a (Jan)
—memorial contributions in honor of A. C. Remington, Harold E. Schwing, Donald McNeil, and Gilbert M. Barrett, 22a (Jl)
Western Industrial Health Conference, 3rd annual: announcement, 26a (S)
Western New York Society of Industrial Medicine and Surgery
—fall meeting: announcement, 30a (O)
—midwinter meeting, 21a (Fe)
—officers and directors elected, 24a (Mar)
—spring meeting: announcement, 19a (May)

About the Authors

MARVIN L. AMDUR, M.D., is a native of Pennsylvania. He graduated from the University of Buffalo with the M.D. degree in 1936 and thereafter served an internship at Sisters of Charity Hospital and a residency at Lafayette General Hospital in Buffalo. After two years of general practice, DR. AMDUR entered industrial practice on a full-time basis as a partner in the Blanchard Industrial Clinic. This later became known as the Buffalo Industrial Medical Center and the Buffalo Industrial Hygiene Laboratories with DR. AMDUR as medical director. The activities of this facility center on the provision of industrial medicine and industrial hygiene services to small industrial firms in the Niagara Frontier Area. It is in this connection that DR. AMDUR had the opportunity to study the cases reported in this issue under the title, "A Clinical Study of an Accidental Group Exposure to Acetonitrile."

DR. AMDUR is a fellow in several specialty organizations: Industrial Medical Association, American Academy of Occupational Medicine, American Public Health Association, and American College of Preventive Medicine. He is certified in occupational medicine by the American Board of Preventive Medicine. He is on the faculty of the University of Buffalo as an Assistant in the Department of Preventive Medicine and Public Health (Industrial Hygiene).

URBANO C. POZZANI, CHARLES P. CARPENTER, JOHN H. NAIR III, PAUL E. PALM, and CARROLL S. WEIL (An Investigation of the Mammalian Toxicity of Acetonitrile) were, until Mr. Nair's recent change of location, associates in the Chemical Hygiene Fellowship of Mellon Institute, Pittsburgh. This Fellowship is supported by Union Carbide Corporation and has for many years been productive of authoritative reports of toxicity studies performed upon materials of commercial importance to that concern.

MR. POZZANI is a native of Massachusetts. He received the B.S. degree in chemistry and the M.S. in biochemistry from the University of Massachusetts. During the war he was associated with the Manhattan Project at the University of Rochester and was concerned chiefly with the toxicity of uranium compounds. He has since 1946 been with the Chemical Hygiene Fellowship, in which he is now a Senior Industrial Fellow.

DR. CARPENTER is a graduate of Franklin and Marshall College. He subsequently pursued graduate studies at the University of Pennsylvania which led to the Ph.D. degree from that institution in 1937. He was thereafter briefly Assistant Professor of Public Health and Preventive Medicine at Pennsylvania. He joined the Chemical Hygiene Fellowship at Mellon Institute in 1940 and is now Assistant Administrative Fellow.

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*Peck, S. M., and others: A.M.A. Arch. Dermat. and Syph. 67:263, 1953.

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About the Authors

MR. NAIR was until recently a member of the Chemical Hygiene Fellowship, concerned with the biochemical aspects of the work of that group. He is now at the Microbiological and Biochemical Research Center of Syracuse University Research Corporation. MR. NAIR is a graduate of Hobart College and received the M.S. degree from the University of Pittsburgh in 1948.

DR. PALM is pathologist to the Chemical Hygiene Fellowship, in which he holds the title, Senior Industrial Fellow. He received the Ph.D. degree from the Division of Biological Sciences of the University of Pittsburgh in 1954. Extensive postdoctoral work at Armed Forces Institute of Pathology, Haskell Laboratory, and the University of Pittsburgh School of Medicine have given him unique qualification in the pathology of experimental animals.

MR. WEIL was awarded the B.A. and M.A. degrees in medical bacteriology in 1939 and 1940, respectively, from the University of Missouri. He was a bacteriologist for the Anchor Serum Company, and he studied the toxicology of butadiene at Mellon Institute. From 1943 to 1945 he was a unit head, investigating the toxicity of uranium compounds for the Manhattan Project at the University of Rochester. He then returned to Mellon Institute as a member of the Union Carbide-sponsored Chemical Hygiene Fellowship, where he is still concerned with the toxicological evaluation of commercial compounds. He now holds the title of Senior Industrial Fellow at that institution, where his special interests include biometrics and carcinogenicity.

MR. DONALD C. FLECKENSTEIN is author of the article "Radiation Protection—Standards and Laws." He graduated *cum laude* from the University of Minnesota in 1950 with a B.A. degree in physics and chemistry. Upon graduation he went to work for the General Electric Company, asigned to Hanford Atomic Products Operation. There he received broad training in radiological hazards control, became head of the radiation instrument calibration service, and then Manager, Personnel Development. In the last position he had responsibility for the man radiological training programs that are operated at the Hanford facility.

MR. FLECKENSTEIN is now Consultant for Radiation Protection throughout the General Electric Company. In this capacity he provides technical advice on radiation protection to managers and professional people of the 70 to 75 departments of that company which are engaged in radiation activities. His responsibilities include the development and promotion of suitable radiation protection standards throughout industry by participation in outside groups.

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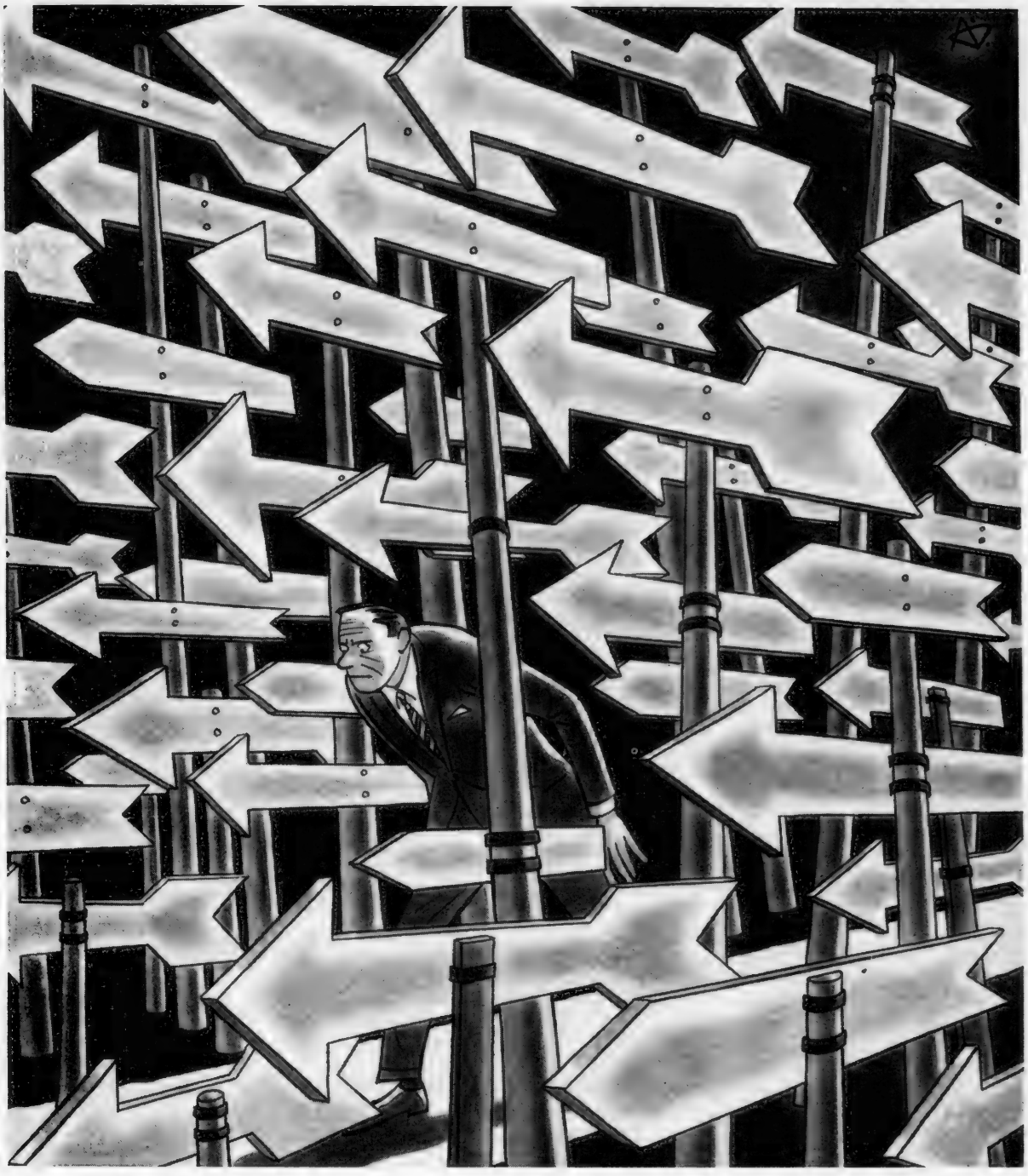

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People and Events

► THOMAS H. DAVISON, M.D., became Medical Director of the Kenosha (Wis.) plant, American Motors Corporation, on October 1. He had been staff physician with Abbott Laboratories since January of this year, and prior to that was Plantation Physician for B. F. Goodrich Company in Liberia, West Africa.

DR. DAVISON did his undergraduate work at the University of Chicago and the University of Illinois. He received his M.D. degree from Northwestern University School of Medicine in 1948, and interned at Wesley Memorial Hospital in Chicago.

He was Staff Physician for the Firestone Plantations Company, a rubber plantation subsidiary of Firestone Company, in Liberia from 1950 to 1953. He served as a Captain in the Medical Corps of the U.S. Army in Korea and Japan in 1953-55. He then returned to Liberia in 1956 to establish a hospital and medical department for the Goodrich Company's new rubber plantation development.

DR. DAVISON is a member of The American Society of Tropical Medicine and Hygiene, The Royal Society of Tropical Medicine and the Industrial Medical Association.

► G. H. FRANCK, M.D., has been appointed Assistant Medical Director of Western Electric Company in Chicago. He will be associated with JERMYN F. MCCAHAN, M.D., Medical Director.

DR. FRANCK received his M.D. degree from Indiana University School of Medicine in 1955, and was awarded the Master of Public Health degree in Industrial Health from the University of Michigan in 1957. Since 1957, he has been with the U.S. Public Health Service, serving at the Occupational Health Field Headquarters in Cincinnati.

► JAMES L. SALOMON, M.D., has been appointed Medical Director, Wichita Division, Boeing Airplane Company. He has been

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The Occupational Health Institute's Certificate of Health Maintenance recently was awarded to The Maui Pineapple Company's Haliimaile Division in Hawaii. The presentation was made by Dr. William H. Wilkinson, district counselor for the Industrial Medical Association, who presented the award to J. Walter Cameron, president of the company. Staff members witnessed the presentation. Left to right: Dr. Wolfgang Pfaeltzer, Mrs. Dora Kurasaki, Minoru Miyauchi, Eileen MacHenry, Mr. Cameron, Dr. Wilkinson, Irene Moltzau and Dr. J. Alfred Burden, head of the company's medical department.

staff physician with Boeing since last June.

DR. SALOMON attended DePauw University in Greencastle, Indiana, and received his A.B. degree in 1941. He obtained his M.D. degree from Northwestern University School of Medicine in 1945 and interned at St. Luke's Hospital in Chicago. From 1946 to 1951, he was instructor, then clinical assistant and later clinical associate in the Department of Surgery at Northwestern. He completed a surgical residency at Hines VA Hospital in 1951.

DR. SALOMON was with the Lynn Clinic in Detroit from 1951 to 1953, when he joined the Ford Motor Company as Physician-in-Charge at the Ford Division in Highland Park, Michigan. He was transferred to Chicago as Medical Director of the Aircraft Division in 1956.

► FRANK W. BARDEN, M.D., has joined the staff of the W. L. Macon Medical Center in St. Louis. DR. BARDEN was formerly Director of the Bureau of Occupational Health for the Missouri Department of Health.

DR. BARDEN did his undergraduate work at the University of Wisconsin and received his M.D. degree from St. Louis University in 1931. He interned at Missouri Baptist Hospital in St. Louis and has done postgraduate work at New York University and Yale University.

He began his industrial medical career in 1934 when he became part-time Medical Director for A. B. Chance Company. In 1943 he became full-time Medical Director for Republic Aviation Corp. He left Republic in 1948 and joined Saco-Lowell Shops as Medical Director, a position he held until 1958 when he moved to Missouri.

DR. BARDEN is a Fellow of the Industrial Medical Association.

► A. WALTER HOOVER, M.D., has been appointed Assistant Medical Director of the Pennsylvania Railroad at Philadelphia, succeeding ROBERT S. AYERLE, M.D., who resigned.

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People and Events

Pennsylvania's Medical Director, DR. A. M. HURSH, in the over-all direction of the railroad's 47 full-time doctors assigned to the medical program for its 80,000 employees.

DR. HOOVER received his medical degree from the University of Virginia in 1949, and interned at Cincinnati General Hospital. He served two years with the medical corps of the U.S. Air Force before entering private practice in 1952. He joined the Pennsylvania Railroad in 1957 as a medical officer in Buffalo, N.Y., and served as regional medical officer at New York before assuming his present position.

► Industrial Medical Association of Philadelphia elected the following officers and directors at a meeting held on October 28: President — WALTER VERNON, M.D.; President-Elect—HOWARD J. JOHNSON, JR., M.D.; Secretary—CHARLES E. RIGBY, M.D.; Treasurer — SAVERIO F. BRUNETTI, M.D.; directors—STEPHEN A. CHRISTIDES, M.D., HENRY A. SPANGLER, M.D., THOMAS KERR, JR., M.D., and LESTER H. HERGESHEIMER, M.D.

The final scientific meeting of the year was held December 2 at The Magee Memorial Hospital for Convalescents, with FRAZER PERRY, M.D., Medical Director, presiding at a clinic on "Rehabilitation of the Physically Disabled."

► WILLIAM J. BURNS, Exhibit Manager for the Industrial Health Conference, has been appointed to serve as a technical consultant on exhibits for the 1959 White House conference on children and youth. Participating will be educators, physicians, parents and specialists in recreation and child counseling.

► Members of the Industrial Medical Association in western Ohio have formed a prospective component society of the IMA. Recent ballotting by mail of 114 IMA members in the area resulted in the election of the following officers and directors: President—JACK HARRIS, M.D.; Vice-President—B. D. DINMAN, M.D.; Secretary-Treasurer—DENNIS F. CASH, M.D.; directors—HELEN COMPTON, M.D., J. H. HEGE, M.D., and CHARLES E. WORK, M.D.

► The New York Academy of Medicine, in association with the New York Heart Association is running a five-session course on Cardiovascular Disease in Industry. The first session, held November 12, dealt with rheumatic heart disease. The second session is scheduled for December 10, and the others for January 28, February 4 and 11.

► Territorial Association of Plantation Physicians held its annual meeting on the island of Maui, November 12 to 14. The name of the Association was changed to Hawaii Association of Plantation Physicians.

The keynote speaker was DONALD STUBBS, M.D., of Washington, D.C. The program was made up largely of panels devoted to the discussion of the changing

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► New York State Society of Industrial Medicine held its annual meeting at the New York University Club on December 1. The program included two presentations as follows: "Workmen's Compensation Is Rehabilitation" by COL. SOLOMON E. SENIOR, chairman, Workmen's Compensation Board of the State of New York; and "Current Developments in Malpractice Litigation" by WILLIAM F. MARTIN, Counsel, Medical Society of the State of New York.

► The People to People Health Foundation, Inc., is completing plans to launch a hospital ship on a citizens' medical mission to Southeast Asia. Manned by volunteer doctors, dentists, and nurses, the ship will operate as a mobile training and treatment center for the people whose shores it visits. President Eisenhower has personally encouraged the venture as an international expression of good will, and the Navy has made available from its "mothball fleet" the 800-bed Consolation, veteran of the Pacific conflict.

Under Project HOPE—Health Opportunity for People Everywhere—the floating medical center will be operated as a nonprofit enterprise. Costs will be met by subscriptions from individuals, corporations, and other foundations. The medical supply trades will help in refitting the ship. The American President Lines has offered a crew.

The permanent medical staff will include 10 physicians, expert in various fields of medicine and surgery; approximately 20 graduate nurses, technicians, and practical nurses; and 10 to 15 epidemiological, nutritional, sanitation and public health units with mobile equipment. Additional temporary personnel, serving three-month tours, will be elected by a committee representing U.S. medical colleges.

The main purpose of the mission is to help the peoples of Southeast Asia improve and expand their own medical teaching professions, and to this end a curriculum has been planned and supplemented with audio-visual aids. But the ship and its staff also will be ready to swing into action against epidemics or other health emergencies.

► Western Industrial Medical Association elected the following officers and directors at a meeting held on October 3 during the Third Annual Western Industrial Health Conference in Los Angeles: President—VERNE G. GHORMLEY, M.D.; Vice-President—CLARENCE L. LLOYD, M.D.; Secretary—BIRCHARD M. BRUNDAGE, M.D.; Treasurer—CLARK R. MILLER, M.D.; directors—JAMES P. HUGHES, M.D., and JAMES RYAN, M.D.

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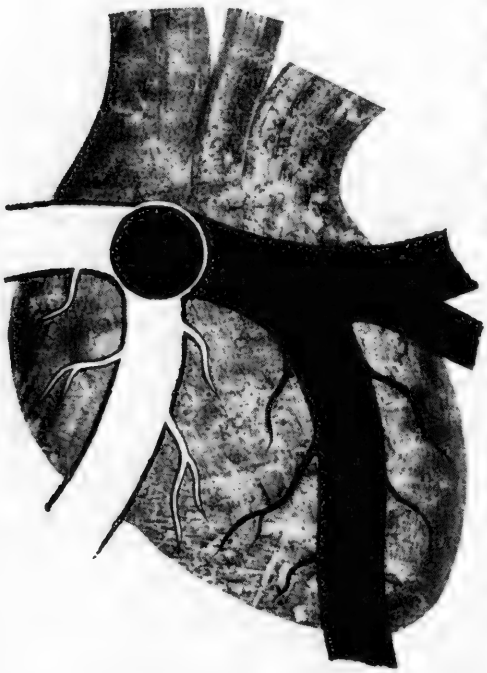

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—*Early Management of Myocardial Infarction:* B. E. Pollock; Journal of the American Medical Association, 161:404 (June) 1956.

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Statement required by the act of August 24, 1912, as amended by the acts of March 3, 1933, and July 2, 1946 (Title 39, United States Code, Section 233) showing the ownership, management, and circulation of Journal of Occupational Medicine, published monthly at Chicago, Illinois, for October 1, 1959.

1. The names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Industrial Medical Association, Inc., 28 East Jackson Blvd., Chicago 4, Ill.; Editor, A. G. Kammer, M.D., 2057 Beechwood Blvd., Pittsburgh 17, Pa.; Managing Editor, none; Business Manager, Clark D. Bridges, 28 East Jackson Blvd., Chicago 4, Ill.

2. The owner is: Industrial Medical Association, Inc., 28 East Jackson Blvd., Chicago 4, Ill., a voluntary association of physicians incorporated not-for-profit in the State of Illinois. There are no stockholders.

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5. The average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the 12 months preceding the date shown above was: This information not required of monthly publications. (Signed) Clark D. Bridges, Business Manager.

Sworn to and subscribed before me this 2nd day of September, 1959. (Signed) Lillian Liddy. (My commission expires October 19, 1959.)

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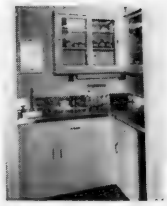

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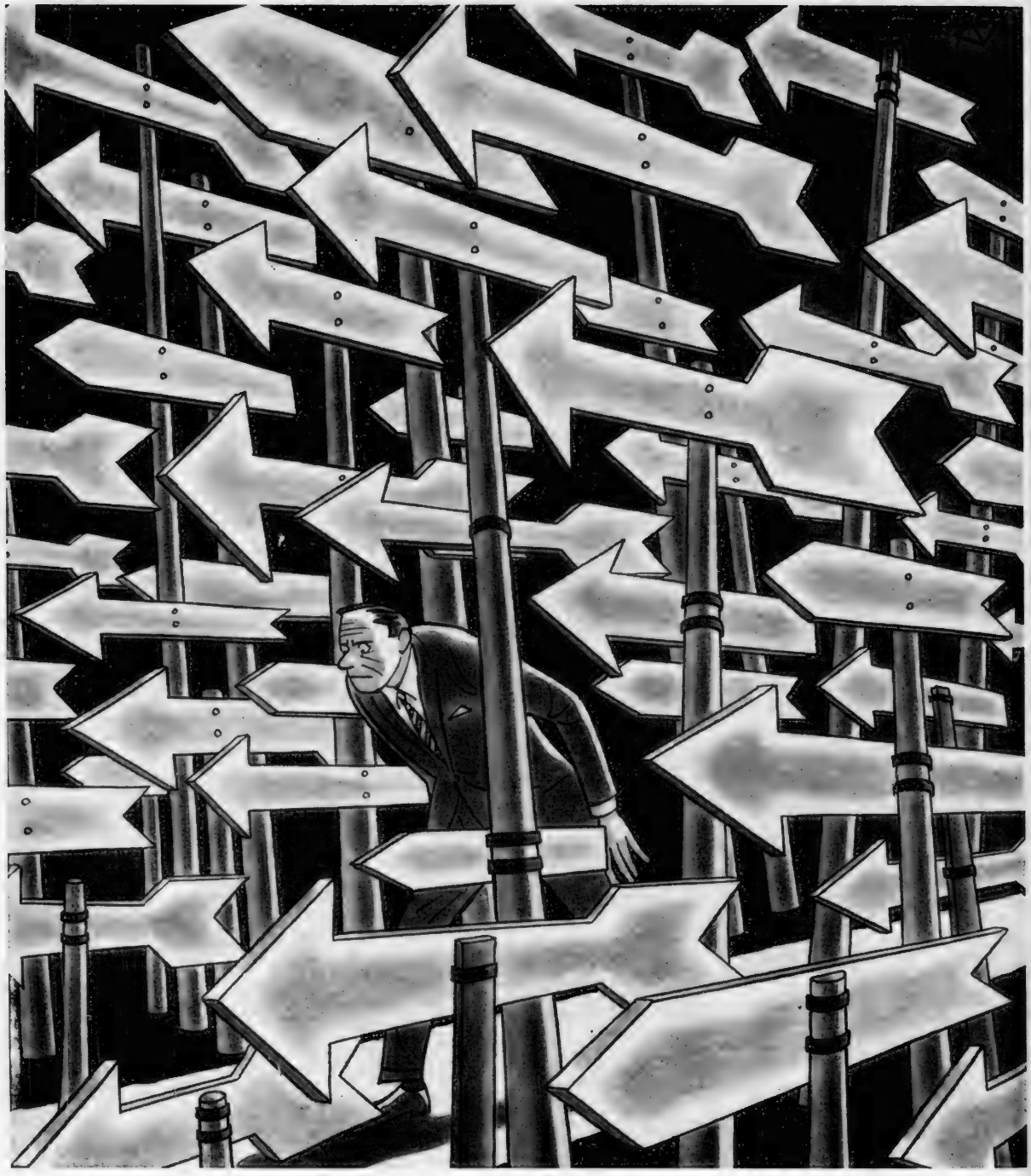

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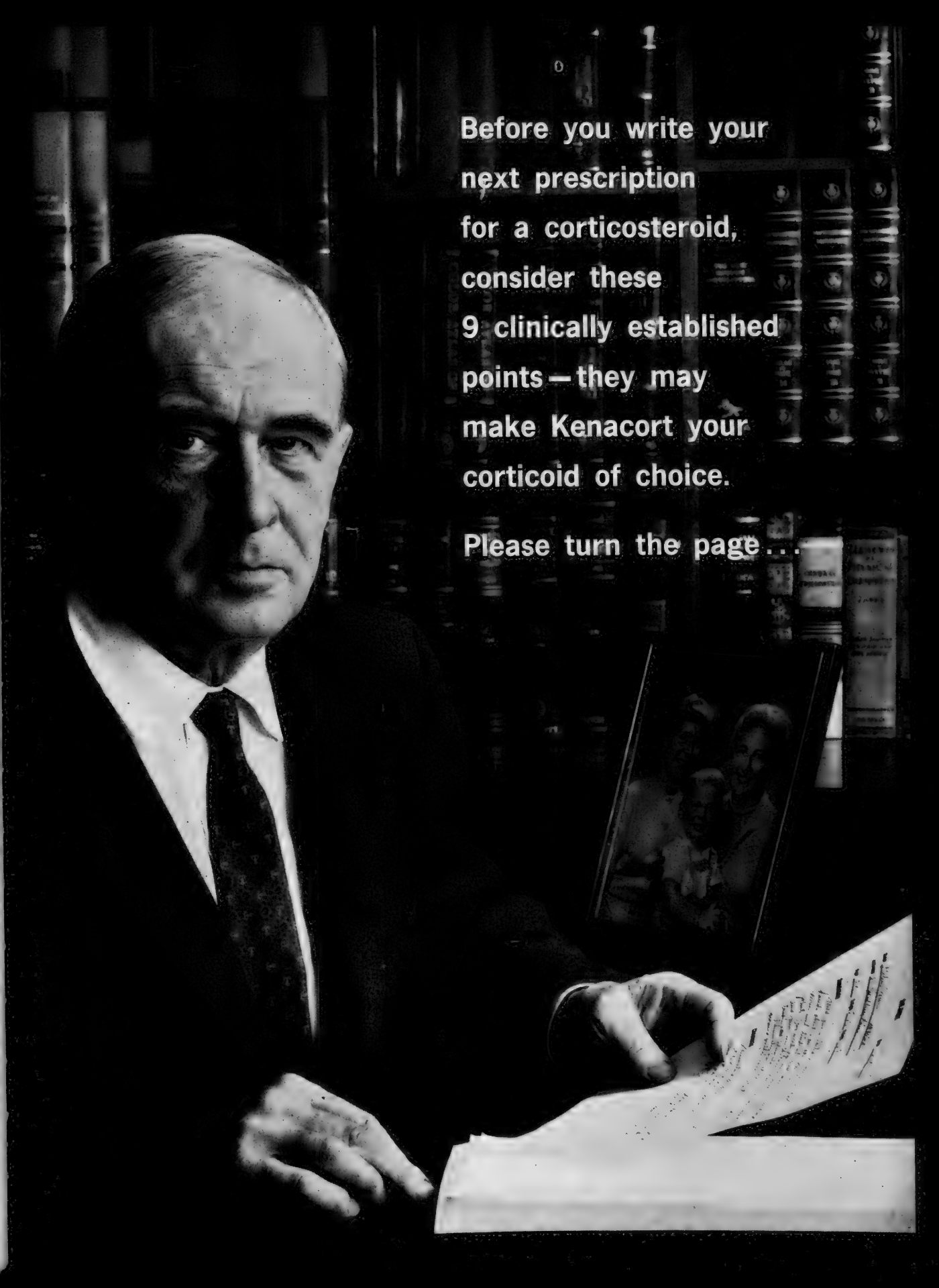
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for choice corticosteroid therapy

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pre-prescription point number **1**

initial therapy—remarkably free from complications

Allison, J. R., Sr., and Allison, J. R., Jr.: Monographs on Therapy 3:99 (Oct.) 1958.

pre-prescription point number **2**

continuing therapy—maintenance doses are low

Feinberg, S. M.; Feinberg, A. R., and Fisherman, E. W.: J. A. M. A. 167:58 (May 3) 1958.

pre-prescription point number **3**

no sodium or water retention—low salt diet not necessary

Hartung, E. F.: J. A. M. A. 167:973 (June 21) 1958.

pre-prescription point number **4**

absence of edema

Council on Drugs: J. A. M. A. 169:257 (Jan. 17) 1959.

pre-prescription point number **5**

less likely to create electrolyte disturbance

Bongiovanni, A. M.; Mellman, W. J., and Eberlein, W. R.. J. Pediat. 53:3 (July) 1958.

pre-prescription point number **6**

no secondary hypertension—no significant change in pulse, respiration, or blood pressure

Shelley, W. B.; Harun, J. S., and Pillsbury, D. M.: J. A. M. A. 167:959 (June 21) 1958.

Bernsten, C. A., Jr., and others: New York Rheumatism Association, Annual Meeting, New York, April 9, 1959.

Kenacort

(SQUIBB TRIAMCINOLONE)

Available in 1 mg., 2 mg., and 4 mg. scored tablets.

pre-prescription
point number **7**

no excessive appetite

Council on Drugs:
J. A. M. A. 169:257 (Jan. 17) 1959.

pre-prescription
point number **8**

without unnatural psychic stimulation —does not stimulate and rarely depresses the mood

Shelley, W. B.; Harun, J. S., and Pillsbury, D. M.:
J. A. M. A. 167:959 (June 21) 1958.
Council on Drugs:
J. A. M. A. 169:257 (Jan. 17) 1959.

pre-prescription
point number **9**

gastrointestinal complaints infrequent

Hartung, E. F.:
J. A. M. A. 167:973 (June 21) 1958.

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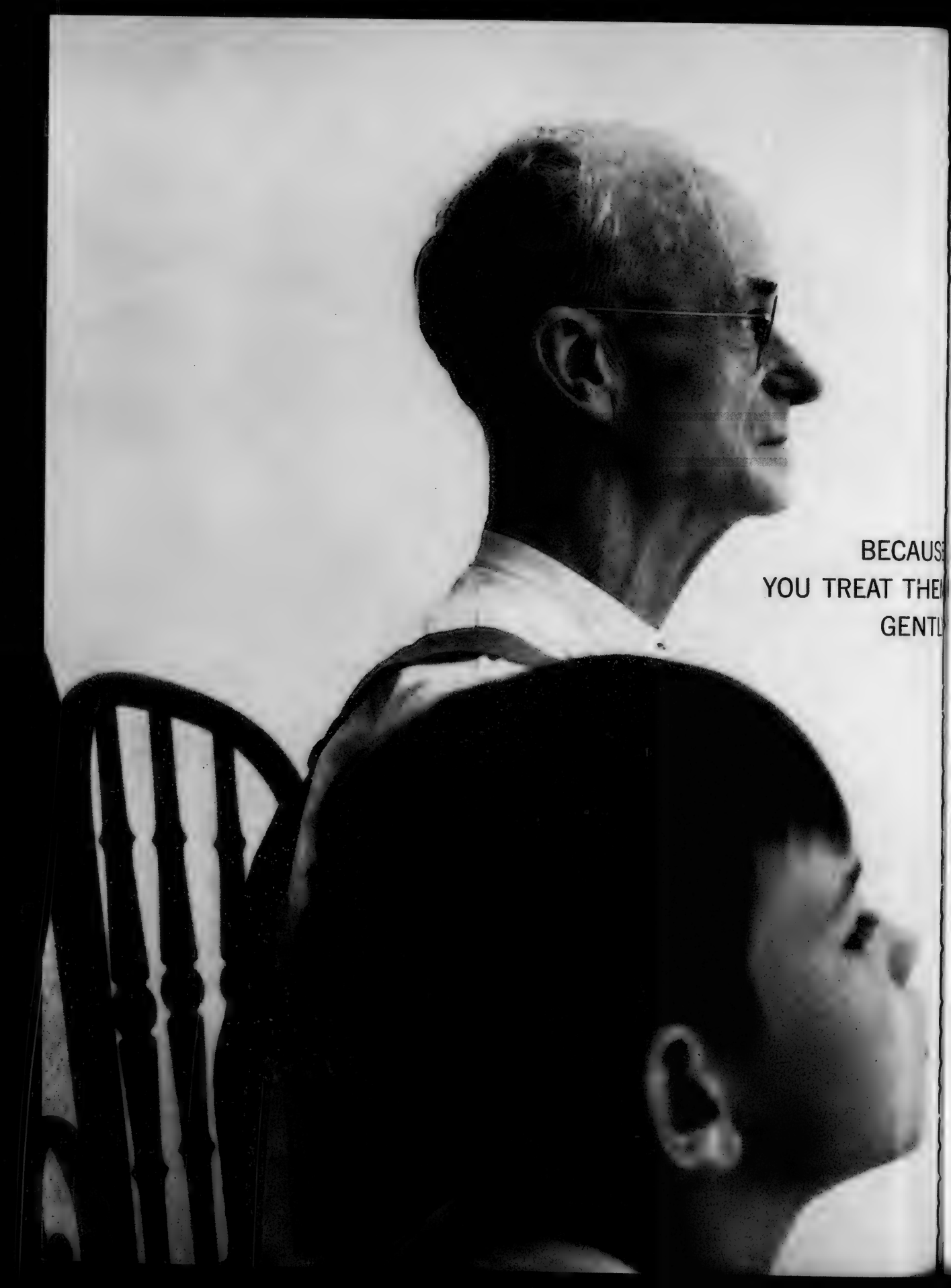
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REFERENCES: 1. Kolodny, A. L.: Antibiotic Med. *6*:452 (Aug.) 1959. 2. Davis, M. R.: To be published. 3. Peluse, S.: In press.

Otrivin® hydrochloride (xylometazoline hydrochloride CIBA)

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Absorbed from the gastrointestinal tract, GRIFULVIN is deposited in the keratin of the skin, hair or nails in fungistatic amounts. Organisms are thus held in check while the keratin containing viable but inactive fungi is gradually exfoliated and replaced by noninfected tissue.

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DISC SYNDROME

SPRAINED BACK

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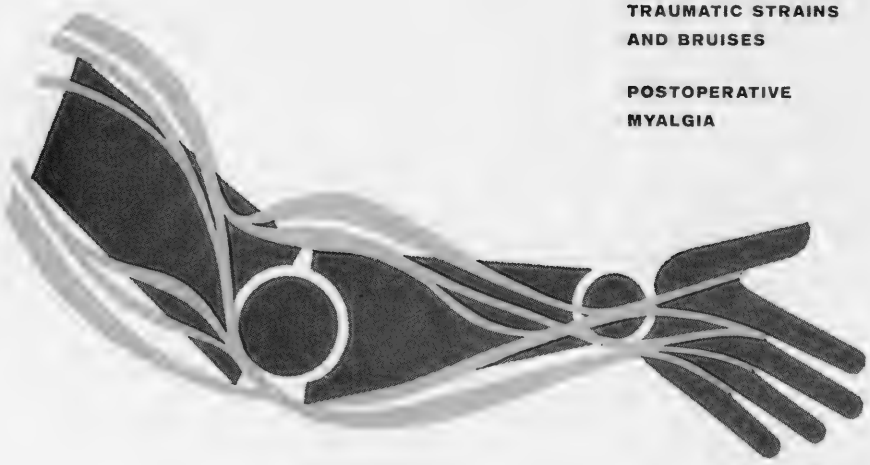
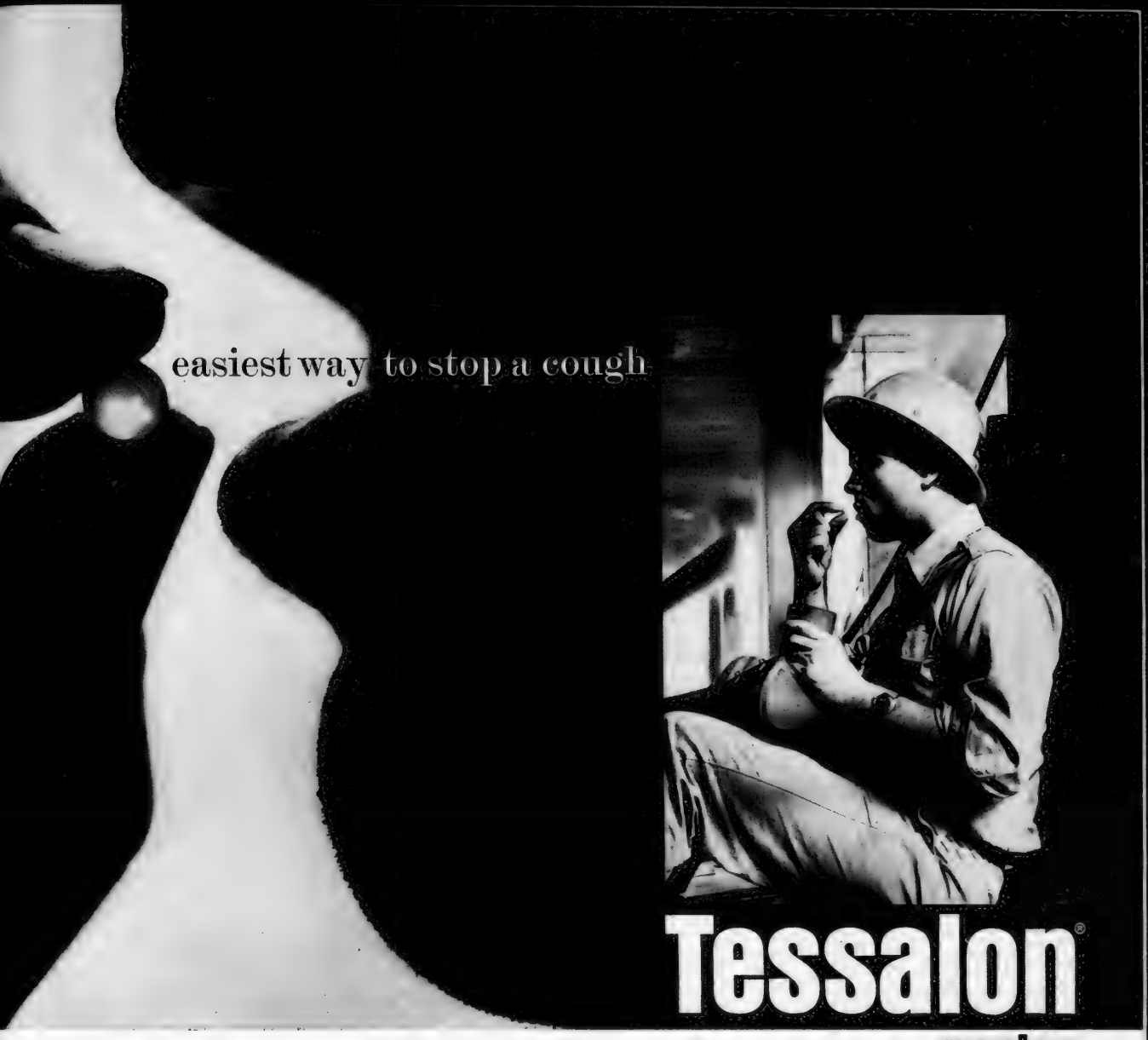
TRAUMATIC STRAINS AND BRUISES

POSTOPERATIVE MYALGIA





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1. Shane, S. J., Krzyski, T. K., and Copp, S. E.: Canad. M. A. J. 77:600 (Sept. 15) 1957.

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SERPASIL®
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for the anxious hypertensive with or without tachycardia

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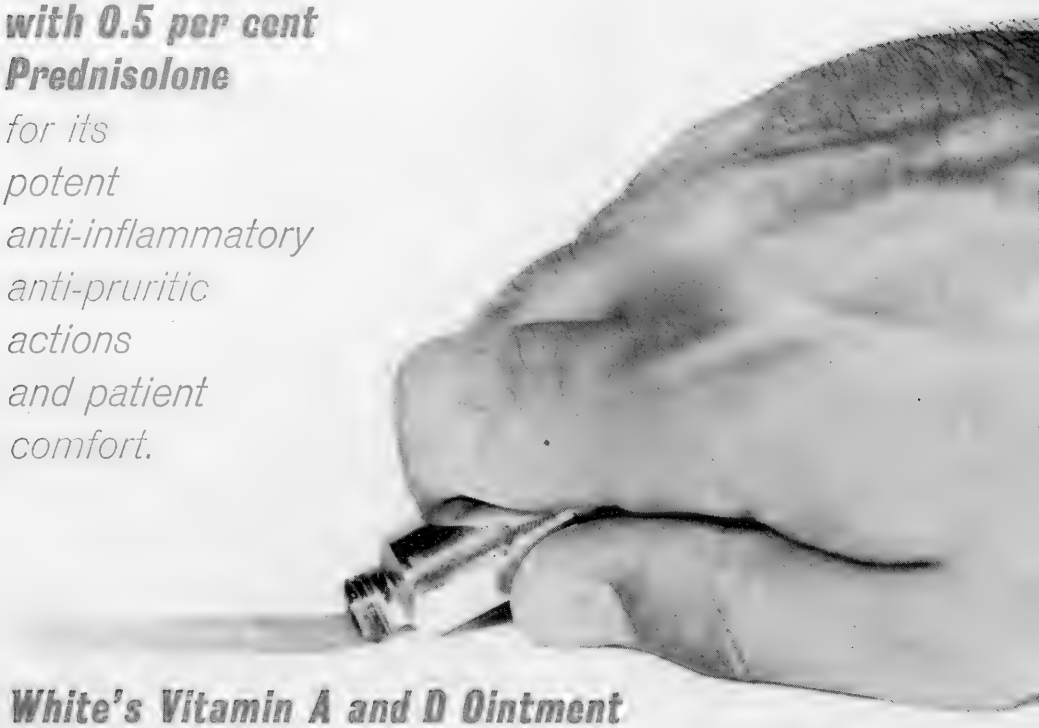

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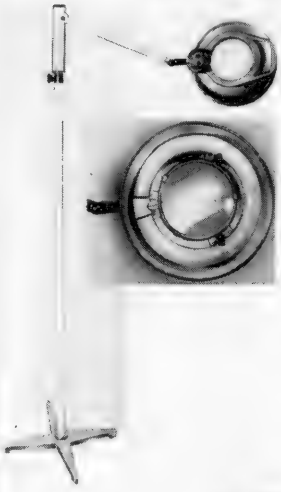

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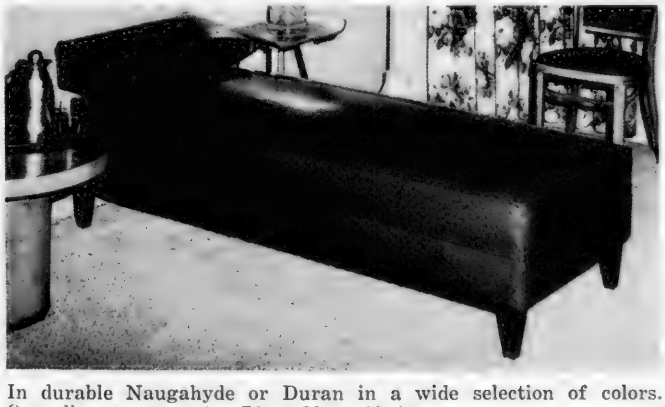

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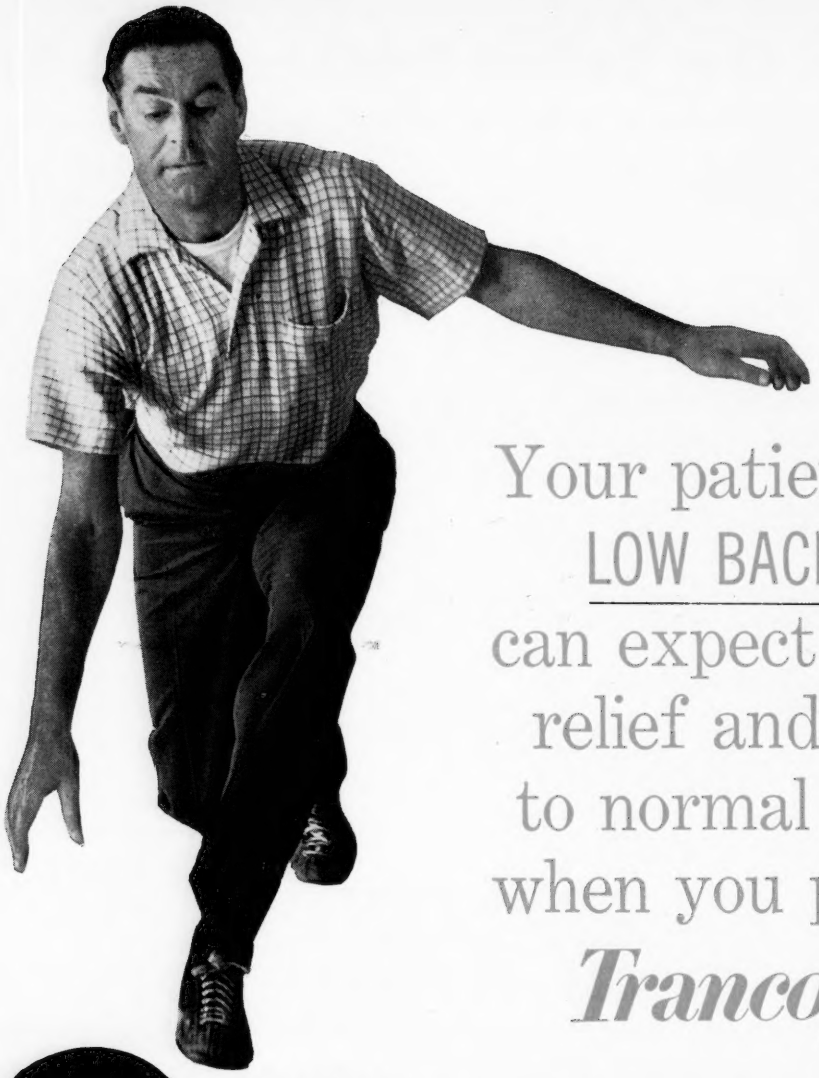

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case profile.[1] A 42-year-old truck driver and mover injured his back while moving a piano. The pain radiated from the sacral region down to the region of the Achilles tendon on the right side. X-rays for ruptured disc revealed nothing pertinent. The day of the injury he was given Trancopal immediately after the physical examination. Although 100 to 200 mg. three times a day were prescribed, the patient on his own responsibility increased the dosage of Trancopal to 400 mg. three times a day. This dosage was continued for three days and then gradually reduced over a ten day period. During this time, the patient continued to drive his truck. The muscle spasm was completely controlled and no apparent side effects were noted. For the past six months, the patient has continued to take Trancopal 100 to 200 mg. as needed for muscle spasm, particularly during strenuous days.

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Now available in two strengths: Trancopal Caplets®, 100 mg. (peach colored, scored), bottles of 100. **New strength**—Trancopal Caplets, 200 mg. (green colored, scored), bottles of 100.
Dosage: Adults, 100 or 200 mg. orally three or four times daily. Relief of symptoms occurs in from fifteen to thirty minutes and lasts from four to six hours.

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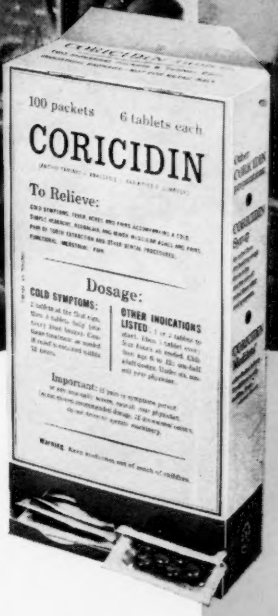

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